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THE FOUNDRY

A TRADE JOURNAL DEVOTED TO THE INTERESTS OF THE WHOLE FOUNDRY BUSINESS

Contents

CO-OPERATION—HENRY CRIBBEN..... 1
EDITORIAL 9
The Foundry Trade — Our Fourth Year — Scrap Heap — Krank's Korner.....
TWO BEAUTIFUL CASTINGS—Illust..... 12
CAST IRON NOTES — W. J. KEEP..... 15
PHILADELPHIA FOUNDRYMEN'S ASSOCIATION..... 16
FOUNDRY COSTS — A. SORGE, JR..... 17
THE MARKET..... 20
AMONG THE FOUNDRIES 21
FIRES 21
WESTERN FOUNDRYMEN'S ASSOCIATION 22
QUESTIONS AND ANSWERS 22
DEATHS 23
RATHER LOSE THAN QUIT 23
TO MAKE A BAD CASTING GOOD..... 24
WANTED..... 24
POKEY'S POINTERS..... 25
MALLEABLE CAST IRON, Illust.—H. R. STANFORD..... 27
PRESSURE ON MOLDS, Part III—H. M. RAMP 34
JAMES CHALMERS (Cont'd.)—W. EDWARD 37

SEPTEMBER, 1895.

Vol. VII No. 37.

Published Monthly by THE FOUNDRY PUBLISHING CO.

DETROIT, MICH.

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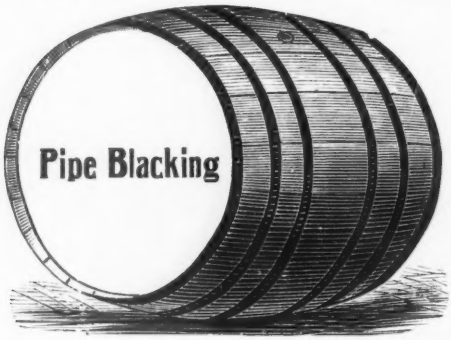

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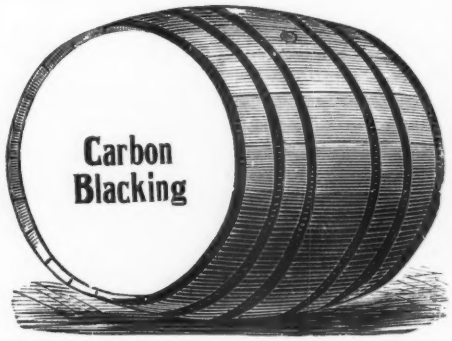

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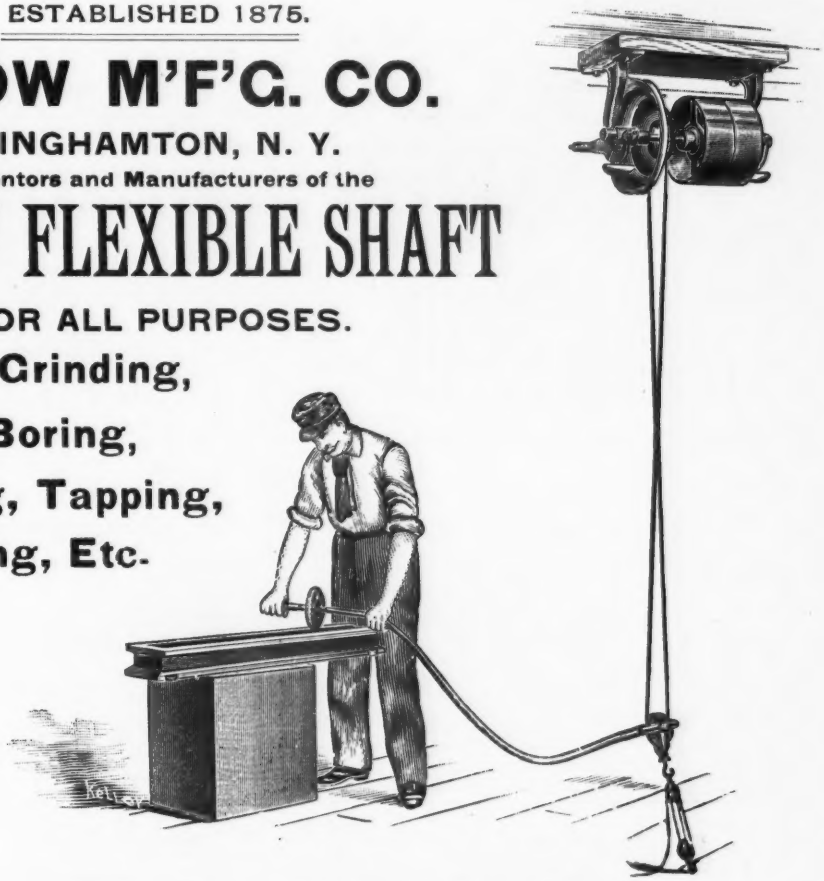

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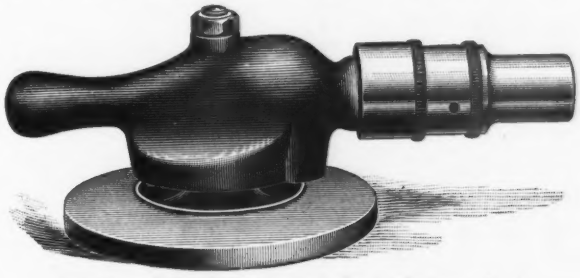

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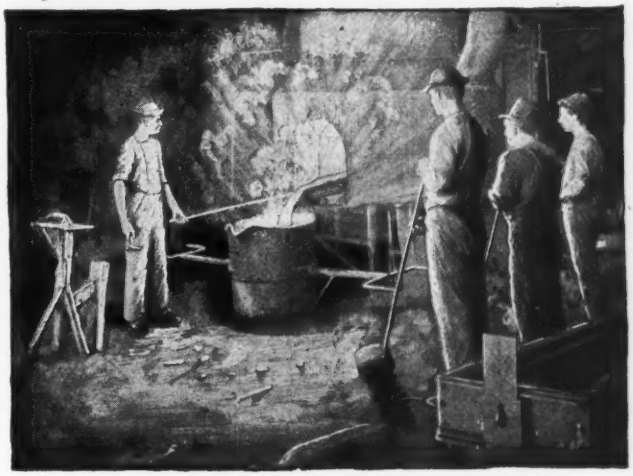

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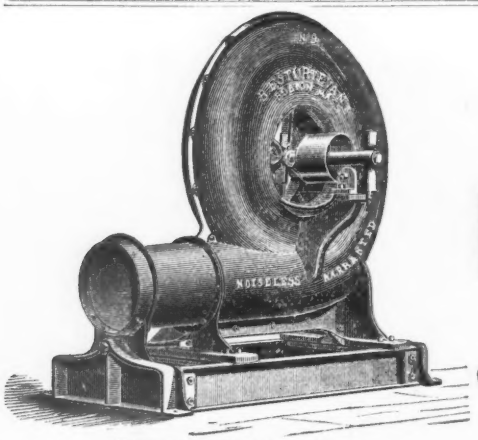

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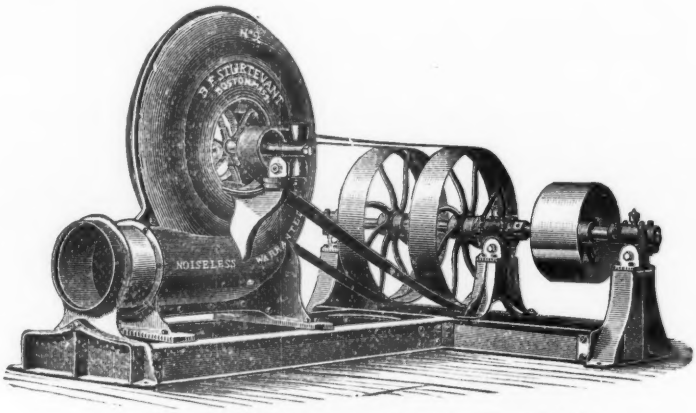

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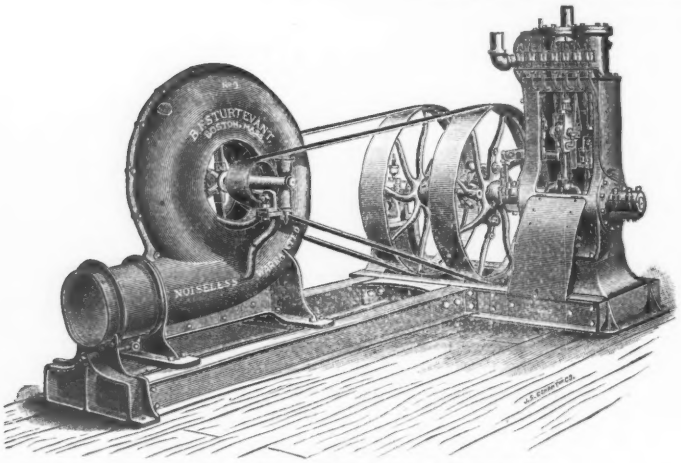

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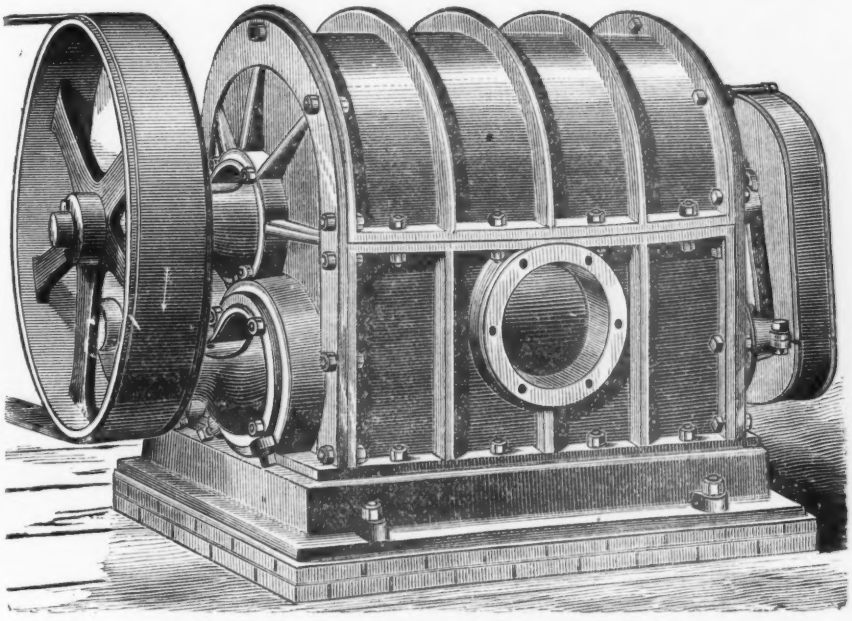

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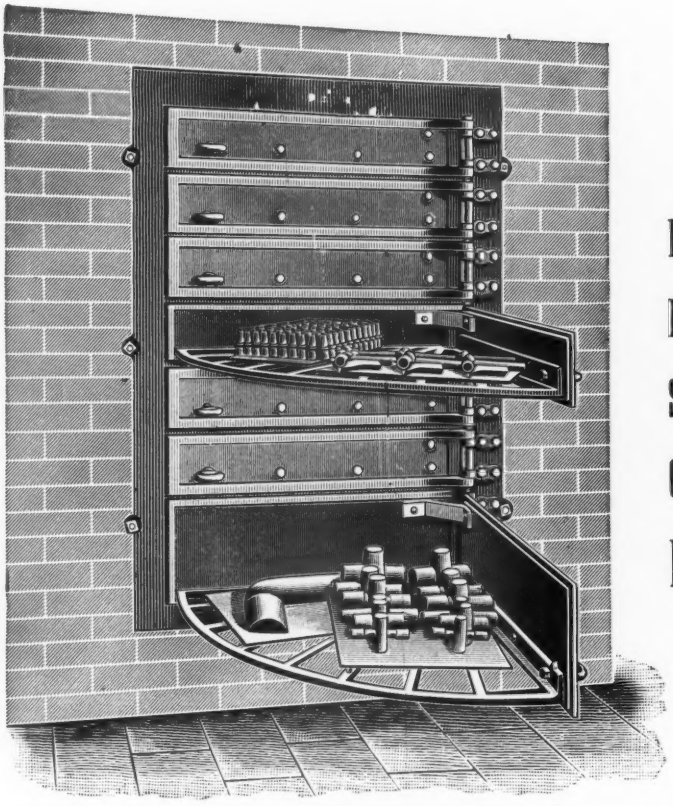

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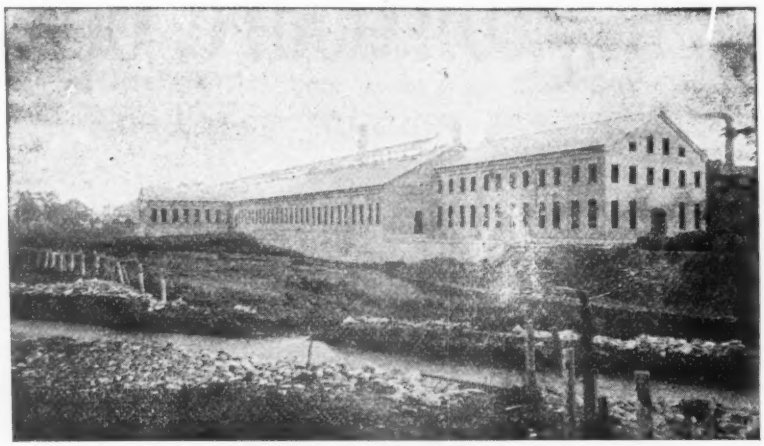

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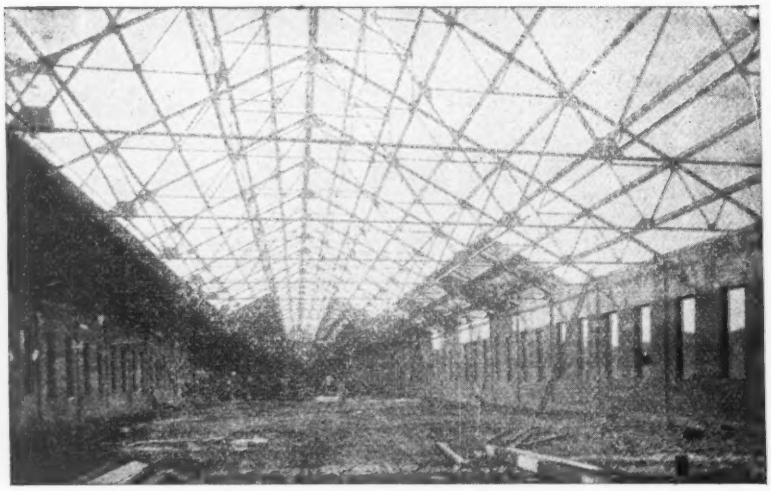

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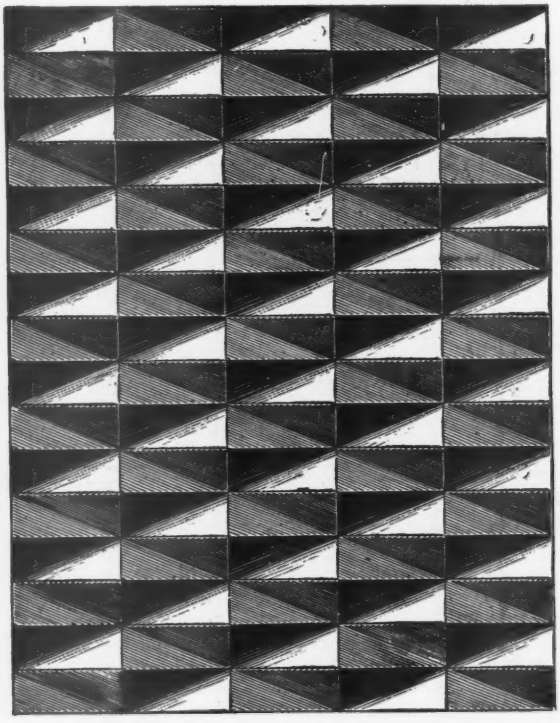

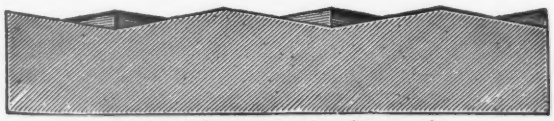

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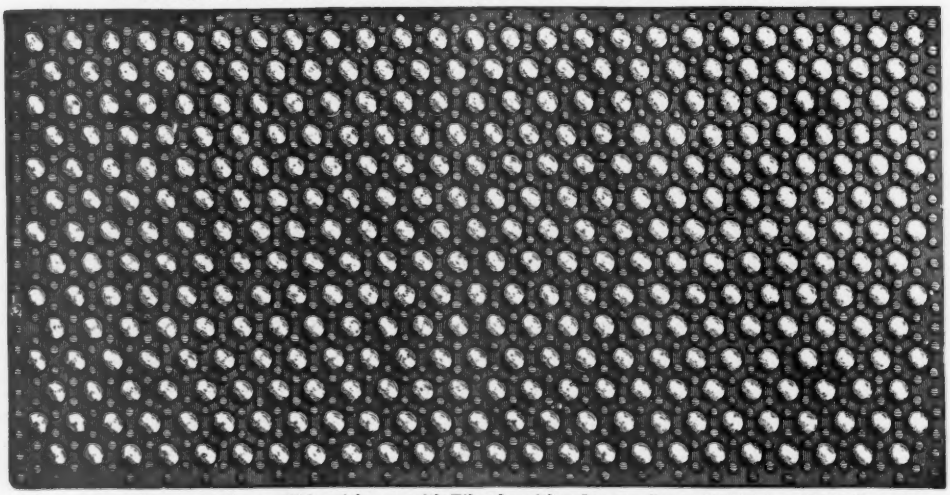

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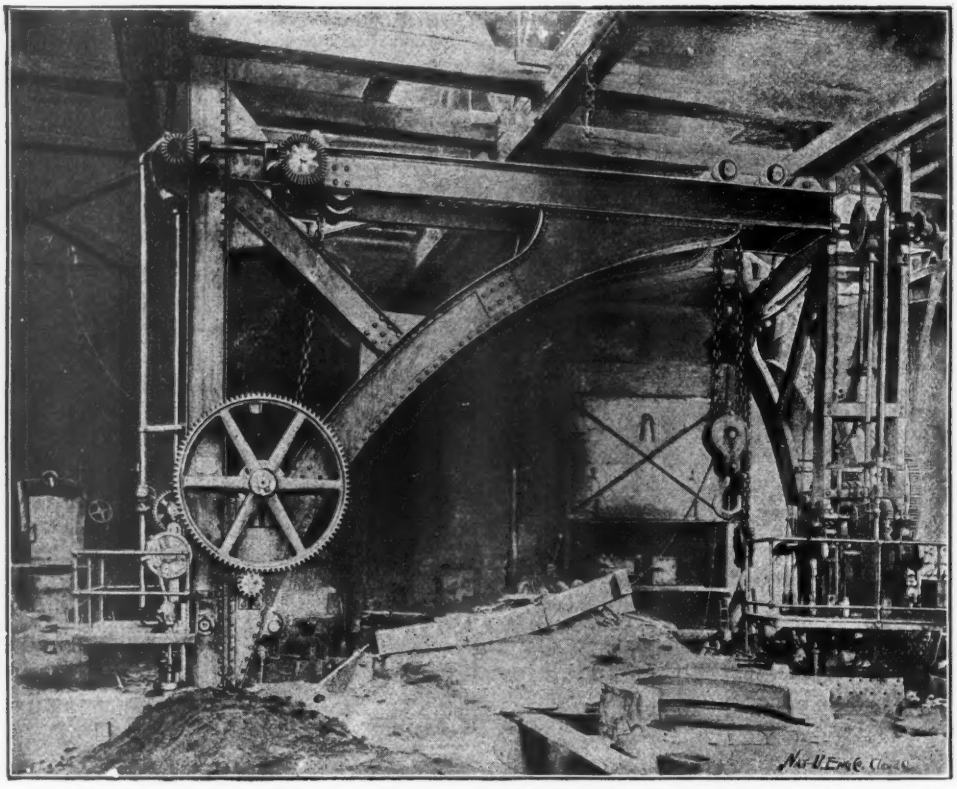

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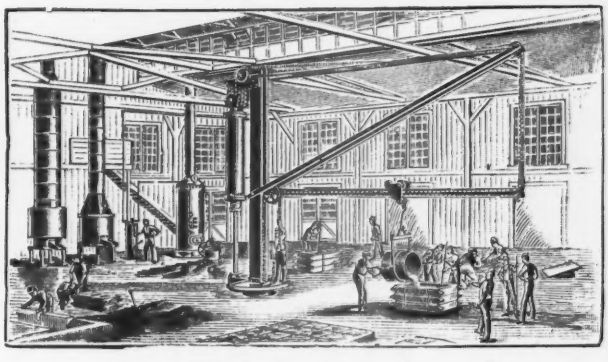

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Signed by one of the largest and best equipped foundries in the West, employing over 1,600 men.

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CRAIG RIDWAY & SON:

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Signed by the largest manufacturing concern in this line in the world, employing 4,000 men. They have, since writing this, put in more of them.

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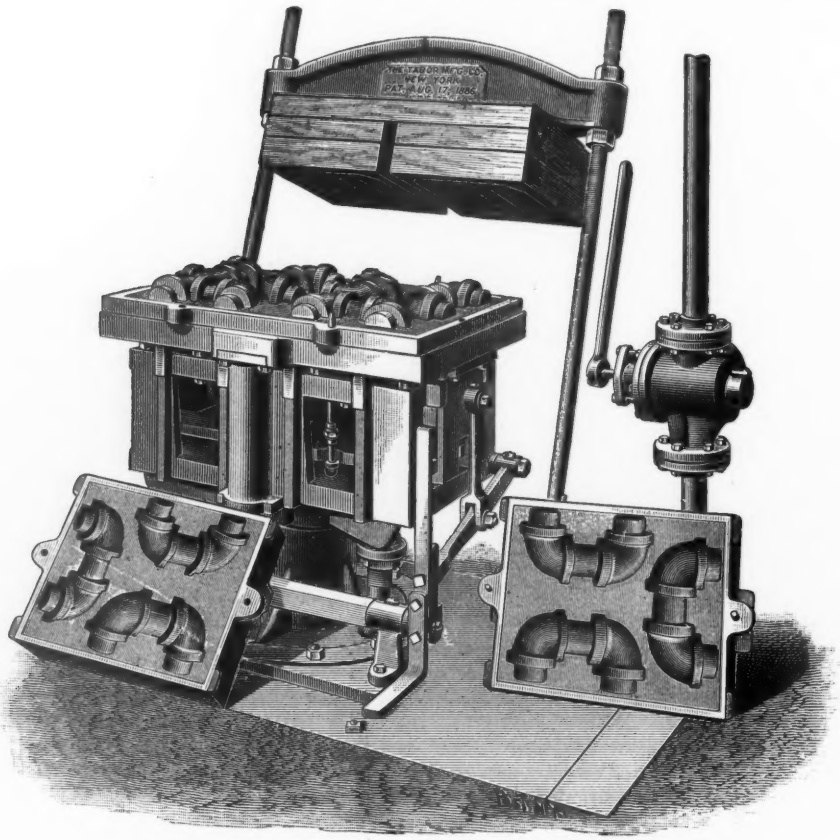
For Sand Molds for Metal Castings.



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These machines are adapted to general castings when made in reasonable quantities.

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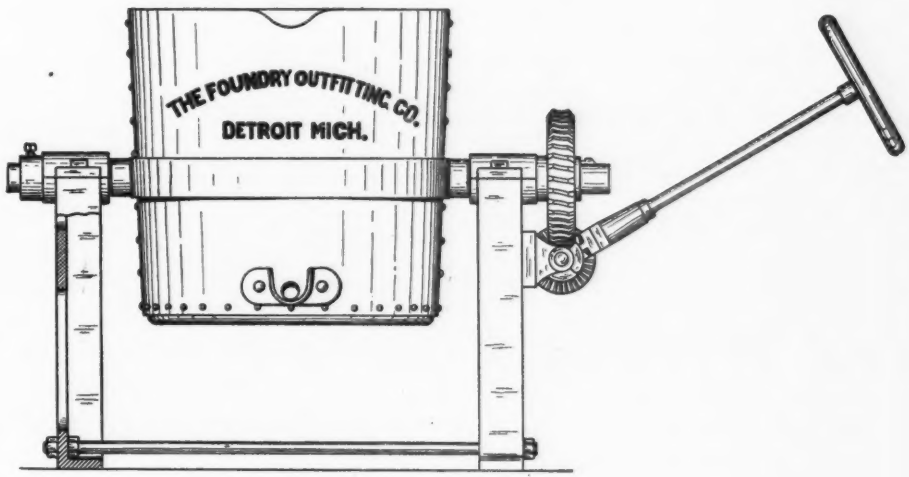

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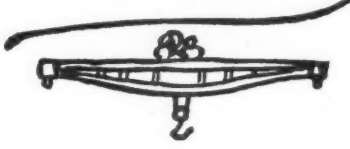

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THE FOUNDRY

VOL. 7. DETROIT, MICH., SEPTEMBER. 1895. No. 37

*Co-Operation.

HENRY CRIBBEN.

Mr. President and Gentlemen:

If you expect from me a flight of eloquence, you will meet with disappointment. Oratory is not my forte. My education was neglected in my youth, being compelled to leave school to earn my daily bread when I was twelve years of age. But I shall try to present to you some plain truths on the true relations that should exist between employer and workmen and hope to convince you that co-operation honestly conducted is the only true method by which the labor problem can be practically solved.

You are all no doubt aware of the fact that to be once a member of the Iron Molders' Union is always to be a member, unless expelled. There is no such thing as resignation known among you—at least, there was not when I was an active member of this body, and I believe the laws relating to membership remain unchanged. When one of the members in good standing quits the bus-i ness or becomes a foreman or superintendent of a foundry, he is given an honorary card. So in 1868, being a member in good standing and having organized the Co-opreative Foundry Company, at Rochester, N. Y., in 1867, and being elected its president, Union No. 12 took my case under consideration, and as I am neither a foreman nor superintendent, they decided I was an employer and they sent me an honorary card, which I still have in my possession, and which constitutes me a full-fledged member of this association without voice or vote.

Many present, no doubt, are aware of the fact that I was one of the charter members of this national association, and I will simply say that I am pleased to meet you on this occasion and extend to you the fraternal greetings and good will of the Stove Founders' National Defense Association, of which I have the honor of being president; and I trust the amicable relations that have existed between the two associations for the past few years will continue to the mutual advantage of all parties interested, and can assure you that the existing relations, as all must admit, are a great improvement on the conditions that existed up to 1887 and 1888. I know and feel that they can be improved upon, by the honest co-operation of both associations in carrying out the recommendations of their conference committees, and refraining from taking any undue or unfair advantage of each other. You must recognize the fact that all recommendations of your conference committees have been carefully considered by them and unanimously adopted before they are submitted to either association for their approval, and, therefore, entitled to your most favorable consideration and respect. Both associations are supposed to select their most competent, honest and capable men to represent them in these conferences, and they would not agree to recommend any measure that would prove injurious to the interests of either association represented in the conference. Where certain abuses have crept in and become the unwritten laws of the union, or of the manufacturers, and your representatives in conference after a careful consideration of the case, and by the unanimous vote of every member, recommend a change for the common good of both, such action on their part should meet the approval of both associations. If they do not meet such approval, our conferences will prove a dismal failure, and will come to an end. Therefore, it is the duty of every delegate present at this convention on his return home to educate the members of his union in such matters that will naturally come before these con-

*Paper read beford the Twentieth Convention of the Iron Molder's Union of North America, by Henry Cribben, of Cribben, Sexton & Co , Chicago, Ills., President of the Stove Founders National Defense Association and Honorary Member of the Iron Molders Union of North America.

ference meetings. All must admit that much good has been accomplished by them up to the present time, and much more can be accomplished by following the tenets of the golden rule—always "do unto others as you would that others should do unto you." It is a fact recognized by all reasonable men that it is impossible for labor to prosper, unless the employer of that labor receives a fair return for the labor and capital invested in his business.

This is a matter of simple business you are called upon to consider, and all that is required to solve it is the application of good, sound common sense and common honesty of purpose to secure the best results for the mutual benefit of all. If you will earnestly and honestly set about it the same results can be accomplishd by the machinery molders and their employers that have been accomplished by the stove molders and the Defense Association.

It is truthfully said that organized labor and organized capital have equal rights, so long as they respect the rights of each other and their interests. Situated as our two associations are, they should be mutual and good, sound common sense and common good and material advancement of both. They should make proper use of the advantages to be secured by such associations, and no fine distinctions should be drawn between them. They should be managed with wisdom, reason and common sense; they should act fairly and honorably with each other, and each should be measured by the same rule, and if they are honestly conducted, both will prove a blessing to their members and their posterity.

Labor leaders must cease preaching the doctrine that all associations of employers are organized for the purpose of reducing the wages of workmen, and are known as capital combines and monopolies, as the Defense Association, by its acts in the past, has proved the falsity of such statements. If it is wrong for employers to organize and try to regulate the selling price of their goods and defend themselves against the unjust and unreasonable demands of their workmen, why is it not also wrong for workingmen to organize for the purpose of increasing their wages, thereby enhancing the selling price to the consumer of the goods they help to manufacture? Why should it be right on the part of one to organize and wrong on the part of the other to do the same thing? Each have many good qualities that will recommend them to their members, so long as they do not allow greed and avarice to predominate in their councils and become unmindful of the rights of others, and it is not in good taste on the part of organized labor to claim the earth (so to speak), and all that the earth produces as well. You must recognize the fact that the employer has rights to a part of the productions of the earth as well as the workmen. And as both the union pot and the employer's kettle are painted with the same brush and the same colored paint, they must be measured by the same rule, and if they are properly conducted will prove profitable to both.

No sensible person will question the right of either to associate themselves together for their own advancement, or for any other lawful or laudable undertaking for the benefit of their memberhhip, but we cannot afford to treat with contempt the right of others who are not associated with us, and often for very good and sensible reasons, not necessary to mention here. It is the duty of each to make their associations so attractive and profitable that those outside will be drawn into them, and will be made to feel that they cannot afford to remain outside of them. This is what the Defense Association is trying to do, and has been quite successful. There is no good reason why the union could not be made so attractive and profitable that all reputable molders would want to become members. But this cannot be accomplished on the lines of policy heretofore pursued by this union. It will take time to educate your members up to the standard required. To make your union attractive to those outside you must be patient and bear with them, and try to convince them that you all have one common interest, which is to improve your condition morally, socially, intellectually and financially; and you should insist upon the honesty, frugality and sobriety of your members.

This is a Utopian scheme whereby men who are in penury and want, often caused by their own neglect or imprudence, are legislated into wealth by statutory laws, but it is to be accomplished by brave, intelligent, self-reliant and industrious men, who are

capable and willing to stand on their own bottom and breast the storms of life.

Socialistic schemes of every kind and description exist in the fertile brains of many labor leaders, who are ready and willing to throw upon the national, state or municipal governments the duty of furnishing employment and wages and providing for the support in sickness or health of those who labor for a living, instead of teaching them lessons of self-help among each other. But all such schemes are impracticable and chimerical and doomed as failures in advance.

I believe that every man is fairly entitled to all the fruits of his labor, his skill, and his opportunity. I am, and always have been, a firm believer that the skillful and rapid molder is entitled to higher wages and better opportunities of employment than the slow and oftentimes inferior workman; and to deny him that rightful advantage is an outrage upon justice, whether it be perpetrated by an employer or a trades union, for by denying him that right you destroy his usefulness to himself and family and prevent him from accumulating funds for the betterment of his condition, when the opportunity offers, and transform the good, rapid workman into a careless and slothful mechanic by bringing him down to the level of the slow and inferior workman, instead of compelling the slow or inferior workman to improve up to the plane of the good and rapid wrkman. Because your lot has been cast in the sand heap of the foundry as a molder in either branch of the business, there is no good reason why you are doomed to remain there the remainder of your natural life. Every molder should be master of his business, earn good wages, and save them by practicing sobriety, thrift and economy in his current expenses—let him be married or single—and with his money, energy and ability be prepared to go into the same business for himself, or join with his associates who have saved their earnings, and become your own employers. This has been done successfully in foreign countries, and also in our own to a very limited degree, and in my judgment it is the only true and practical solution of the labor question.

Thirty years ago I was sent as a delegate from Union No. 12, of Rochester, N. Y., to the national convention of the Iron Molders' Union that met in old Tammany Hall, New York City, and stood upon the floor of that convention and urged upon that representative body the abandonment of strikes, except as a last resort, and to make provision for the establishment of foundries, on what is known as the co-operative plan, and tried in my humble way to outline how it could be successfully accomplished; but, strange to say, before the plan could be fairly set forth by the speaker, calls of order were heard in different parts of the room. I paid no attention to that, and went on with my subject, but the cries of "order" and "sit down" became so numerous that the president, W. H. Sylvis, was unable to maintain order, and I was compelled to subside and take my seat. Mr. Simon F. Mann, of Troy, N. Y., and William R. Burgess, of Providence, R. I., undertook to assist me, but they were treated in like manner.

This being a more enlightened decade, I feel that you will listen to the plan I then tried to set forth, as the solution of this most important question of labor and capital, that was to be worked out and accomplished in twenty-five or thirty years.

The plan was as follows:

First, incorporate the national association in some state, or secure a charter at Washington and establish permanent headquarters in some city centrally located; resolve to avoid strikes by all possible means, only to be used as a last resort, and save money for the purpose of fostering the co-operative movement about to be undertaken. The association was to raise, by assessment upon its members, $40,000 or $50,000 annually; one half to be paid during the first six months, and the other half to be paid during the last six months of each year. The money to be placed in the hands of five trustees, for the establishment of co-operative machine and stove foundries in the United States, in the following manner: I will take $50,000 annually as the amount of money to be raised by taxation for the illustration. When the first $25,000 was collected, the trustees would offer to invest that amount for the period of four or five years, or more if it was necessary, in any city having a union in good standing whose members, individually and collectively, would subscribe an equal amount of money for stock in such foundry. The board of trustees, who were to be selected for their honesty, ability and

competency to manage such a business, were to constitute a majority of the board of directors, in each and every foundry so established. And taking it for granted that each co-operative foundry so established could be placed on a dividend-paying basis almost within the first two or three years, it would be no trouble for the union to sell its stock to other parties at a premium above this outlay at the time specified, and use the money for the establishment of additional foundries of the same character in other cities. where the prospects of future successful business would present itself. We would establish in the first five years ten foundries, with a paid-up capital of $50,000 each, and if successful in selling the stock of the union at th expiration of five years in each case where the business beame profitable—of which there was no question—at the expiration of ten years we would have ten additional foundries established by taxation, and the stock of the first ten foundries established during the first five years transplanted with the premiums earned, elsewhere, making a total at the end of ten years of thirty foundries; at the end of fifteen years we would establish ten more by taxation, and transplant the stock of the twenty foundries established during the first ten years, making a total at the end of fifteen years of sixty foundries; at the expiration of twenty years we would establish ten more by taxation, and transplant the thirty foundries established during the first fifteen years, making at the end of twenty years a total of 100 foundries; at the end of twenty-five years we would establish ten more foundries by taxation, and transplant the stock of the forty foundries established in the first twenty years, making a total of 150 foundries at the expiration of twenty-five years. At the end of thirty years we would establish ten more foundries by taxation, and transplant the stock of the fifty foundries established during the first twenty-five years, making a grand total of 210 well equipped foundries, with a paid-up capital of $10,500,000, to say nothing of the profits accruing therefrom of at least as much as the paid-up capital of the stockholders, or a grand total of capital and profits of $21,000,000, at an expense to the union in thirty years of $1,500,000.

The above figures show conclusively that the bulk of the stove and machine business of the country would be controlled by the co-operative foundries so established in thirty years, to say nothing of the number of similar foundries that would be established by individual enterprise, and the national association would have a source of revenue that would enable it to do many things it ought to do for its membership, that you are not now in a position to do, for the want of money—such as sick and death benefits, life insurance at a very low rate, and the establishment of a library and reading-rooms with each union in all the leading cities of the country, thereby making your members better men and better citizens. All frugal and thrifty members would own their own homes and have money in bank for investment when the opportunity might offer.

Some of you may think this is a visionary scheme conjured in the brain of a disordered mind, but I stand here as a living exponent of the fact that it could be successfully accomplished, as many present personally know the efforts of myself and associates have accomplished greater results than those herein named. And I assert without fear of successful contradiction, that the plan as outlined could have been successfully carried out, if placed in the hands of honest, capable men for execution.

I returned home from that meeting somewhat discouraged, but finally determined, so far as I was personally concerned, that I should at the earliest opportunity become my own employer, if I could find a sufficient number of molders in Rochester to join me, who were of the same opinion, and had money to buy one or more shares of stock, and began at once to agitate the subject of co-operation, making converts for the new enterprise. Determined to convince my associate delegates to that convention that with $800 of my money and that of my associates, we could become our own employers and enjoy the fruits of our own labor.

A co-operative grocery store had been in operation in Rochester for something more than a year, which had been improperly managed from the beginning to the finish, and when we had secured subscribers for about $10,000 worth of co-operative foundry stock, the stock and fixtures of this co-operative store were about ready to be sold at

auction and the money received from the sale applied to pay its debts. Knowing this, I went to a directors' meeting of the store and informed them that their auction sale would destroy my co-operative foundry enterprise, and urgently requested them to continue their business for two or three weeks more, until I could organize and incorporate, and collect my stock subscriptions for the foundry. They granted the prayer of my petition and we collected $11,500 of foundry stock subscriptions and the sale of the grocery stock and fixtures took place.

Before we had organized or secured any subscriptions to the stock, Mr. N. Brayer and myself purchased the foundry property where the office is now located for the sum of $20,000, subject to a mortgage of $10,000 on a contract, and paid $1,000, $500 each, to secure the purchase, and had ten days to pay over the $9,000. On the ninth day we called for the deed, and the gentleman laughingly remarked it was not ready, and seemed to be surprised to find we had raised the money to pay over and candidly admitted he thought we could not raise the money, and he would pocket our $1,000. After making the payment we had left $1,500 to operate the foundry that for the five preceding years had required something like $120,000 per annum to pay the operating expenses. There was no very encouraging outlook for our new enterprise at this time. We had collected all of the available subscribed capital that was possible at the time; but hearing of a party who was about to engage in the coal business, I went to see him at once, and used my best endeavors to show him the beauties and profits of the stove business, and succeeded in having him loan the company $10,000, secured by second mortgage on the plant and real estate, and we guaranteed him 7 per cent on his money, whether the company made it or not, and as much more as it would earn in the business. We also paid him $2,000 per annum for indorsing our paper discounted at the bank, and would say there were times when the amount of our discounted paper in that bank often exceeded our total paid-up capital seven times. This gentleman remained with us about three years, and when he left us the company paid him a trifle less than $30,000; his earnings in that time on his original investment being nearly doubled.

This company has now a paid-up capital of $200,000 and a surplus of nearly $200,000 more, but the property and plant owned by them could not be purchased for the amount of their capital and surplus combined, as it is worth very much more.

After the great fire in Chicago in 1871 the company sent the speaker to this city to try and collect money due them, and in 1872 opened a small branch house for the company and removed my family to this city. In 1873 they sold me this branch house, and took my notes in payment for the goods on hand, and agreed to give me a line of credit such as the wants of our business might require. At the time I made the purchase I had $1,100 in cash, a horse and a democrat wagon. The balance of my worldly possessions were tied up in the stock of the Rochester Co-operative Foundry Company. Mr. Jas. A. Sexton, who had been in the employ of the company during 1872, working for a small salary, became my partner and had less money than myself, and from that small beginning has grown the present business of Cribben, Sexton & Co., which exceeds that of the Rochester company. The same men are managing the Co-operative Foundry of Rochester at the present time that helped to organize it and undertook the management in 1867, excepting myself. I am still a director of the company. They have managed well, and the stockholders, as sensible men, appreciate the fact, and have re-elected them from year to year since 1867. If such results as herein set forth can be accomplished by five men with little or no capital to start with in business, why, I ask, could not the co-operative plan as outlined be made a grand success, if managed by honest and capable men, with a good working cash capital in every case to begin with, and the officers of the International Union behind the trustees to counsel and advise them in the conduct of the business? The outlook for the thirty years to come is as good for the business as the past thirty years has been, as the foundry business is becoming more localized on account of freight; and there is no good reason why this body should not move in the matter at once and select good, honest and capable men as trustees, and put the co-operative ball in motion; as it is the only plan that will solve this great question of labor and

capital and enable you to become your own employer and enjoy the fruits of your own labor. There are hundreds, yes, thousands, of men in this union more capable to inaugurate and manage a commercial or anufacturing business than the speaker or those associated with him during the past twenty-nine years. Do not select your trustees for their eloquence, or because they are good fellows, and beware of the man who has been a politician or has a desire to become one, using his union as a political pull or stepping stone, to secure any official position under the national, state or municipal government of the country. For when men, as a rule, become the so-called servants of the people, they become dishonest, and when a man does not hesitate to steal from a government which he serves, he will not hesitate to steal from a co-operative foundry company and destroy it; for it is a fact well known to all who have interested themselves and followed closely the movements of the many co-operative stove enterprises that have been inaugurated during the past thirty years and flourished for a short period of time in the United States, that they have been wrecked by poor management, incurring indebtedness, dishonesty on the part of the managers, or too much politics. Is is not to the credit of the representative American workingman to see the indifference and carelessness that exists among them, as to the employment of methods of self-help or co-operation in the solution of the labor question, as compared with the workingmen of Great Britain, who about forty years ago were from sheer necessity compelled to club together to purchase the bare necessities of life; and some twenty-five of the weavers of Rochdale, England, who were receiving only 35 to 50 cents per day for their labor, organized, and rented a small room in Toad Lane, for the distribution of their purchases, which then consisted of rice, barley, oatmeal, tallow candles, etc., such luxuries as meat, coffee, tea and sugar being almost unknown among them. The goods were transported point of distribution in a wheelbarrow by from the mill and wholesale store to this one of the members of the managing committee, who oftentimes in the discharge of their duties were pelted with mud and stones by boys encouraged and paid by storekeepers in the neighborhood, to discourage the men engaged in this embryo co-operative movement, which has by honest and determined effort on the part of a few weavers succeeded beyond the expectation of the most sanguine among their number. They are now running their own mills, and butcher their own cattle, and the amount of their business figures into millions of dollars annually. The success of this co-operative enterprise inaugurated less than fifty years ago has encouraged others to embark in similar co-operative enterprises, increasing yearly, the great majority of which have proved to be successful, increasing their business from year to year up to the present time, until the amount of business done by the co-operative companies of Great Britain has exceeded the fabulous sum of $250,000,000 for the year 1894. Where, I would ask, are the organized American workingmen with their boasted educational advantages? And what have they done during the past thirty-five years or more, as compared with their fellow workingmen of Great Britain, in the direction of self-help and co-operation? Echo answers almost nothing. With all the boasted advantages of the common school, the high school and other educational institutions of this great republic, we have utterly failed to learn the much needed lesson of self-help and by that means secure to their members the fruits of their own labor.

The workingmen of America, with all their boasted educational advantages, have, during the time herein mentioned, been learning how not to improve their condition financially, and are unable to reap the fruits of their own labor, by encouraging strikes and creating and fostering a feeling of hatred between mployers and workmen. Such acts should be discouraged and a feeling of friendship and mutual respect should be encouraged by both organized labor and employer, as the interests of workmen and their employers must be mutual if you wish to succeed. No class of labor can prosper on the financial disintegration and destruction of the employers' business, but on the contrary he should receive the fruits of his labor and capital invested in business, as well as labor, or he will discontinue the operation of his works and a serious loss to both workmen and employer is the consequence. I have watched with great interest every movement made by this union during the

past thirty-six years of its life, and I will ask you as representative men from all parts of the United States and Canada, what permanent financial benefit have you secured for your membership during the past twenty-five years in attempting to advance wages through the instrumentality of strikes? I do not wish to convey the idea, in asking the question, that you have not been temporarily successful in gaining slight advances in wages by means of a strike, when the employer is compelled to choose between the loss of his trade and a temporary compliance with what he considers the unfair and unreasonable demands of the union, and grants, for illustration, the demands of the workmen, which, for example, are 10 per cent, for a short period; but when trade drops off he gets it back with compound interest by reducing wages 15 per cent, and for each case that you will name where the union has secured a permanent and lasting increase of wages by a strike I will agree to name thirty failures. But the facts are, from all the information we have in our possession, there is not, to my knowledge, a single case on record where wages have been permanently advanced or maintained in the stove manufacturing business of this country by means of a strike, and I honestly think the same can be said of the machinery branch of the business. Since the organization of the Defense Association in 1886, and up to the present time, and having passed through one of the most disastrous financial and industrial panics ever known in this or any other country, still there has been no reduction of wages for ten years among the members of that association, with two exceptions, both concerns being very small and both claiming they only equalized with their competitors in their immediate vicinity, which they said they were compelled to do or quit business.

The above truthful showing must convince you that the manufacturers are not desirous of reducing wages, but they do insist upon their competitors paying as much for the same grade of work as they do, which all must admit is perfectly just and proper. And it is your duty to see to it that all manufacturers pay the same price for molding the same grade of goods in competing localities, and that they are treated fairly and honorably by the union. If you will do this, in good faith, the Defense Association will co-operate with you, and your interests will be cared for when the improvement in business will warrant it. If you will honestly compare the conditions of the stove plate molders for the past ten years with the preceding ten or twenty years, you must admit the Defense Association has been your friend. It has maintained molding prices, which the union has been unable to accomplish in the past; and I trust your actions in the future will be such as will improve and strengthen that friendship and not destroy it.

If this feeble effort on my part proves an incentive for you gentlemen to move on the lines indicated, I shall believe that this union which I helped to bring into existence and ardently labored for its success, national and local, for the term of ten years, is finally to be the instrument in the hands of Providence and its members to fulfill the objects of its creation, and the first among the many unions of our country that will have tried to solve this great and momentous question in a practical, common sense manner by the abandonment of the futile efforts of the past thirty-eight years in attempting to improve your conditions financially.

If you should decide at any future time to inaugurate the plan of co-operation, and you consider the advice and counsel of your humble servant of any value to you in the enterprise, you are freely and cheerfully offered those services in advance.

Mr. President, if there is any gentleman present who does not fully understand the relations as herein set forth between the Stove Founders National Defense Association and the stove plate molders in their employ, or if there are any present who are desirous of receiving more light on the subject of co-operation, or any who can truthfully refute any of the statements I have made, they are at liberty to correct me, or ask any questions bearing on the subjects herein set forth, and I will try to answer them to the best of my ability.

With my best wishes for your future welfare and prosperity, I will close.

W. R. Henderson, Jefferson, Texas, will remove his foundry to Shreveport, same State.

Two Good Orders.

We are informed by the Foundry Outfitting Co., of Detroit, Mich., that they have closed contracts with the Magnetite Foundry Co., of St. Louis, Mo., and the United States Boiler Co., of Cheektowaga, N. Y., for the full foundry equipments for their new plants.

J. S. Clark, the well-known Denver foundryman, has organized the Grand Junction Iron Foundry Co. at Grand Junction, Colo., and expects to be running in ninety days.

E. S. Warswitz, whose foundry at Myerstown, Pa., has been closed for some time, has started it up again.

J. W. Paxson & Co., Philadelphia, Pa., seem to have made a point in getting out a small catalogue devoted exclusively to brass foundry supplies. It contains all the equipments, tools, etc., peculiar to the brass foundry, and will prove interesting to those engaged in that business.

Some one will soon call this the "Pneumatic Age," and in doing so will probably be somewhat influenced by reading a good article on compressed air contained in a catalogue just sent out by the Clayton Air Compressor Works, New York. It contains also much information on the subject of compressers, reservoirs, etc.

Whitehead Bros.' Company, of New York, Providence and Buffalo, are giving their best friends about as neat a little pocket memorandum book as we have ever seen. In it they are supposed to record their orders for the celebrated Albany moulding sand which they ship all over America, as well as their various grades of facing and foundry supplies.

HOW THEY SAY IT

The German—Dunder und bhlitzen! Run me der stairs down, shut me der water off, its leaking a whole lot much! !

The Frenchman—Zounds! Stop ze watair. Ve air so foolish zat ve work not right! !

The Englishman—Shut hoff the water! The bloody pipe his leaken hall hover the blooming 'ouse! !

The American——— ! ! ! ! Shut off the —— stop, the ——— water is squirting all over —— ! ! !

The Shaw Crane seems to be Popular.

Work is humming at the Shaw Electric Crane Co.'s factory. "We are increasing our force every day," said J. G. Emery, Jr., "and the outlook is very good. The following orders have been received by the company recently: One 10-ton electric traveling crane for the Watts-Campbell Co., Newark, N. J. This is the second one sold to this company, they have purchased a 20-ton crane two years ago. Two 20-ton electric traveling cranes for the Bellaire Nail Works, Bellaire, O. One 20-ton double trolley, hand traveling electric crane for the United States government for the Watertown arsenal at Watertown, Mass. This crane is a duplicate of the one sold to the government one year ago. One 25-ton special ladle electric traveling crane for the Washburn & Moen Manufacturing Co., Worcester, Mass. This crane will be accompanied by a 40 K W dynamo. Three 20-ton electric traveling cranes and one 50-ton special ladle electric traveling crane for the Apollo Iron & Steel Co., South Chicago, Ill. This is the fifth Shaw electric crane purchased by this firm. One 20-ton electric traveling crane for the Holyoke Machine Co., Holyoke Mass.

Whiting Foundry Equipment Company, Chicago, recently shipped to Denver, Col., the new cupola required for the plant of the Griffin Wheel Company at that place. The cupola is of the Whiting pattern, has a stack 65 feet high and its capacity is 16 tons per hour. The first heat in the new foundry of the Whiting Foundry Equipment Company, at Harvey, Ill., was run off last Friday. The foundry is 102x160 feet in size, brick, with steel roof trusses and columns. A steel charging house 30x50 feet serves the cupolas, of which there are two of the Whiting make, the large cupola having a capacity of 16 tons per hour and the small one of 6 tons per hour. The blower is operated by electricity, as are also the tumblers and other machinery. The elevator will be of the pneumatic pattern. One traveling crane, operated by electricity, is completed, and another traveler, operated by compressed air, will soon be in operation. The latest and most complete appliances will be used throughout. The present work of the foundry will be that of supplying the castings for the cupolas, cranes, air hoists, ladles, etc., maunfactured by this company.

A TECHNICAL JOURNAL DEVOTED TO FOUNDRY INTERESTS.

THE FOUNDRY

Published Monthly by

"The Foundry Publishing Co."

DETROIT, MICH.

JOHN A. PENTON,

EDITOR AND PROPRIETOR.

DETROIT, SEPT., 1895.

Entered at the Post Office at Detroit, Mich., as second-class matter.

SUBSCRIPTION—One Dollar per year in advance in all parts of the United States and Canada; one dollar and fifty cents per year to all parts of the Universal Postal Union. May be sent by express, draft, money order, registered letter or U. S. postage stamps. Single copies, 15c.

CLUB RATES—Eight or more subscriptions sent at one time, 75 cents per year each. Cash to accompany order.

Advertising rates furnished upon application

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THE FOUNDRY is issued promptly on the 20th. of each month, and will spare no endeavor to furnish valuable news and information to those interested professionally or incidentally in molding, melting, mixing of metals, foundry management, etc. Persons connected with any of these lines of industry will confer a favor upon the Editor of this Journal by sending him news from their section of the country pertaining to the foundry interests, particularly individual theories and experiences of practical value.

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The Foundry Trade.

Business seems to be improving greatly and in almost every line. The general jobbing and machinery shops report quite a change for the better. Quite a demand exists for machinery of standard makes, and while engine shops do not appear to be as rushed as they were earlier, they are doing fairly well, especially in the west. The stove foundries seem to be no longer in doubt, as the reports from traveling men seem to warrant them in keeping everlastingly at it. The fall trade can be said to be now fairly under way, and the same policy that has actuated other lines during the past two years, viz., that of holding back, is, it is thought going to result in considerable eleventh-hour business.

Agricultural implement shops have had a good season and some of them are reported as getting ready for an exceedingly busy winter.

They say that hard times and poor crops have kept the farmers from buying during the past few years and compelled him to use his old machinery, but this season good crops in many localities will help him out.

The war of competition among the steel foundries having ceased some time, makes business better with them, and they are reported to be making money and to be busy.

Pipe foundries are not doing as much as they were, and the small margin at which pipe is made is likely to discourage others from going into the business for some time, or until it shall appear that there is enough business to go round.

A good fall and winter's business can be looked for in almost all lines, and it is not likely that any change of an unfavorable nature will take place in the near future.

Our Fourth Year.

With this issue THE FOUNDRY enters on its fourth year. Four years ago this month it ventured timidly to make its bow, but meeting with a hearty reception and an unusual degree of success, that timidity quickly disappeared, and it has since then grown soemwhat, not only in size, but in circulation and influence. This has happened for the most part during a season of unusual depression, and we feel warranted in encouraging our readers to believe that with

returning prosperity we will be able in the future to maintain the steady march of improvement that has characterized its growth thus far.

The very excellent paper on malleable iron appearing elsewhere in this issue should be read by every progressive foundryman. Although it touches upon but few of the distinct features of malleable business, it yet refers to the most important of them and probably contains more information than anything yet published. As the malleable iron industry is steadily growing, owing to the increased demand for that article, it will be of especial interest at this time and may perhaps be the means of inspiring others to contribute further.

The Scrap Heap.

The IRON AGE of a recent issue refers to the great scarcity of boilermakers, and recites some of the inconveniences suffered by manufacturers in different localities caused by their inability to secure competent help.

A few months ago the boilermakers were reported to be largely out of work, but the recent revival in business has created such a demand for the result of their labor that it is now the employer that is looking for men—an exact reversal of the former situation.

* * *

This condition, if it existed for any length of time, would have the effect of materially increasing the cost of labor.

The foregoing situation is not an unusual one, often recurring in fact in more ways and places than one, and before long is going to happen in the foundry business. and for similar reasons.

* * *

The conditions surrounding the work of both boilermaker and molder are very similar. Physical labor, skill and good judgment are the essentials where a good job is required, involving much mechanical ability. In the course of time in this swiftly developing country wages have been so materially reduced that the average American boy does not care to learn a business that promises so little in return for the life of uncertainty and hardships apt to be entailed upon those who follow it, especially if he has any intelligence or ability, and as a result we have the continual complaints about the lack of good workmen.

* * *

Who can honestly blame any boy with ambition, industry and intelligence from linking several of the best years of his life, if not his entire future, to an occupation that is carried on amidst dirt, dust, heat and confusion, and where the remuneration is only a shade above that of common laborers?

* * *

That is why, not only in Philadelphia, New York and other eastern cities, but in the western shops as well, the leading hands are very largely men who have learned their business in England or Scotland principally.

Newspaper articles, speeches and papers read before mechanical or scientific associations are not going to remedy this evil. It will only take a turn for the better when we find we cannot secure good men on every corner; when, in fact, the demand exceeds the supply in such a way as to bring home to the employer the truth that he has always been depending on the "other fellow" for his mechanics, while doing what he thought was best for himself.

* * *

It is coming, sure. Those people who imagine they can recruit the ranks of the boilermakers from the ranks of the iron shipbuilders, because the one business is akin to the other, though not requiring anything like the degree of skill, are as certain to be fooled as the man who depends upon or expects to see the ranks of the skillful machinery molder recruited from the ranks of the stove, bench or agricultural molder.

* * *

All these have their places, and all do good work in their respective lines, but the lines of demarcation dividing them all are becoming more and more sharply defined year by year.

* * *

Selfishness is on all hands such an inspir-

ing motive that as soon as foundrymen or boilermakers begin to realize that they themselves are to blame because their employes do not rank higher intellectually or morally, they will immediately begin to exercise some thought on the subject they now superficially pass over with a few declamatory and deprecating remarks.

Krank's Korner.

I view with considerable satisfaction any discussion that takes place upon the apprenticeship question. After watching a man getting into deep water it is interesting to notice the exertions he makes to get back to solid ground. For years past signs have been put up by one or another saying danger, look out, etc., but no attention was paid to them until the full force of the current was felt. It is a good deal easier to keep out of a muddle than it is to get out of it after once being caught.

* * *

Will the discussion of the apprenticeship question result in any agreement looking towards a more thorough teaching of the molder's art? If there is any foundryman whose conscience refuses to let him sleep because he is not treating his apprentices right, let him do better by them at once. There is no reason why any special agreement should be entered into, in order that each one may do right.

* * *

The difficulties that are in the way of reaching an agreement between such a large number as compose our foundry men and the diversified interests they represent are great. But suppose it even possible to draft a resolution that will receive the signature of the members in what way can it be made binding and effective?

* * *

As things stand now one gets up and says molders are real bad, another that they are getting worse, and one to show how infernally low they actually are getting to be, says they are worser. It appears as if nobody wants to be the first one to turn them the other way. Let the man who is carrying the biggest load on his mind in this respect make a trial with whatever system he believes would make good molders. One actual trial of that kind is with a hundred sermons. Let him put himself in the boys places and act accordingly. The Lord helps nobody like the one who helps himself.

* * *

While considering the question of securing better molders, let us also look at another thing that bears a close relation to the same subject, the price of castings. With the maintenance of better prices, better wages could be paid, this in itself would stimulate molders to become more perfect, and give foundrymen some choice as to whom they should employ, for with a better financial policy governing the trade better men would seek to enter it, and a greater chance would be given to discard the unworthy.

* * *

But where is the agreement by which men would be bound and where is the law that would compel its adoption, and again we must say that the greatest help that can be offered is selfish. That greedy, grasping inclination to cut everybody's price regardless of consequences never helped to make molders as a class of mechanics better, just the opposite has been the effect.

* * *

When I see a St. Louis foundryman coming to Chicago and secure a large order for foundry work by under-bidding the local shops and on the next train see a Chicago man going down to get back at him, I feel mighty certain the molders' wages are not going to be raised until after that contract is filled. I feel sure they will be speeded up to the utmost on such close transactions.

* * *

Even under existing conditions who will deny that every foundry is amply able to train men and produce them as skillful as required, for its own use. The whole trouble of which complaints are now made begins when these refuse to stay in their original positions, the only ones they are competent to fill. If every foundryman would strive to retain the boys he raises to manhood and mechanics within his works, he would have a set of men that could not fail to satisfy him and that would fill the bill admirably,

for they would be acquainted with his requirements from the bottom up. As it is the abilities of the mechanic are seldom noticed at his home, he must look to strangers for a recognition of his talents, and with the continued changing of workmen comes the howling about poor mechanics.

* * *

This age is said to be the survival of the fittest, if that is so, your specialty molder is the one who will survive. When you are kicking your shins because you can't get a molder to make your changing around jobs right off the handle without any experimenting, just cool yourself off with the thought that you have been striving to make molders who only knew how to make one thing and in that way put the most money in your pocket. Becoming tired of their monotonous calling they have attempted to change places, and have become mixed up, the different kinds of them. To remedy this the best tag you can put on men you wish to retain in your employment is such a rate of pay as your competitors will not duplicate.

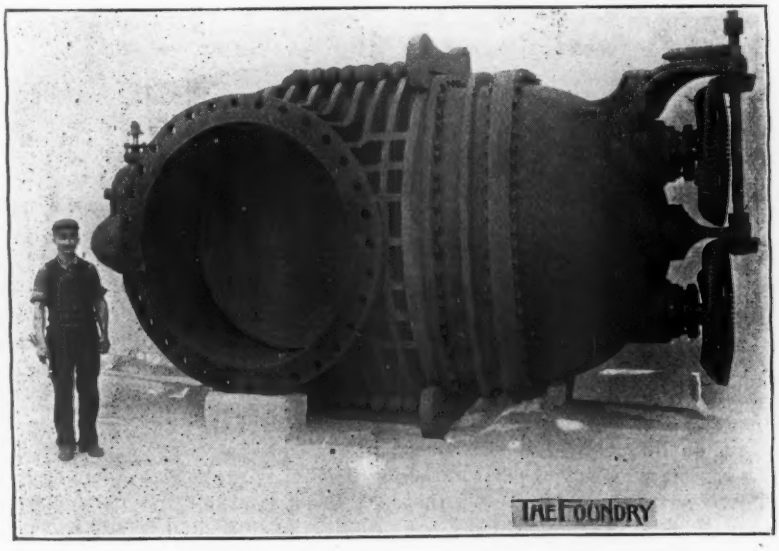
Two Beautiful Castings.

The Rensselaer Manufacturing Co. are located at Troy, N. Y.

We simply make that announcement to refresh the memory of those of our readers who, while familiar with the name, might have forgotten for the moment the location of the firm whose work is attracting so much attention everywhere.

Among their latest achievements perhaps the 60-inch valves made for the water supply of Alleghany, Pa., have attracted more attention than anything else. The two illustrations we print elsewhere will give the reader an excellent idea, not only of their size, but also of the difficulties to be contended with in their manufacture.

They are said to be the largest ever made and a specially built railroad train was necessary to transport them to their destination.

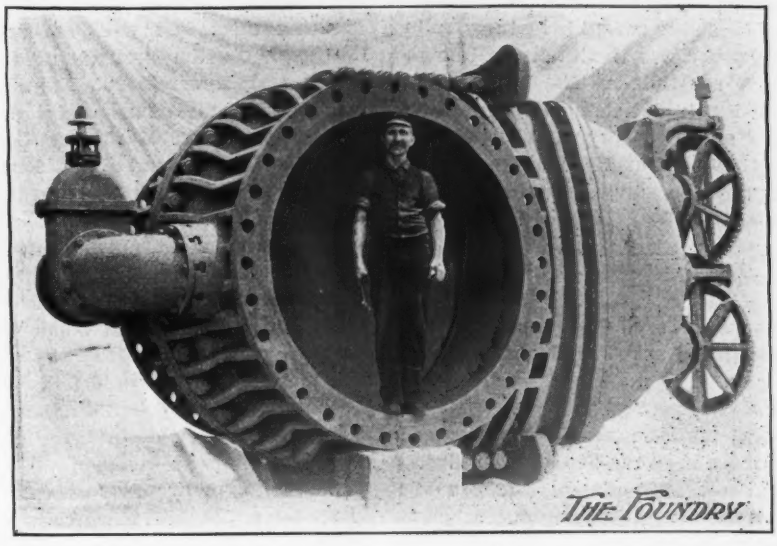


Its length is sixteen feet, height nine feet, width five feet six inches, and weight altogether over twenty-five tons, including about one ton of brass used in mounting the wearing surfaces.

The valves are operated by two solid bronze spindles on which screws are cut four inches in diameter. In designing it great care had to be taken to make it sufficiently strong to withstand the enormous expansion and contraction of a five-foot continuous steel pipe which was riveted to it. The variation in this strain caused by the difference between the summer and winter temperature amounts to 900,000 pounds, besides the strain of external pressure, amounting to 800 pounds per square inch,

and exerting a total pressure against each gate of 663,600 pounds. It was made in green sand except when it was necessary to use dry sand cores to prevent washing, and so perfectly was this done that it was not found necessary to drill a single hole in the casting after it came from the foundry.

It was cast in two halves and bolted together with 2½ inch steel bolts and was made in this way in order to get rid of the tremendous cooling strains likely to occur in a valve so heavily ribbed and with such heavy beams if cast in one piece, and as there are ten of these valves in this one order it will require twenty of these large pieces to complete it. Up to the time of writing fifteen of these have been successfully cast without the loss of a single one. Some



slight idea of the difficulty connected with the successful handling of such work is conveyed in the suggestion that every foundryman can appreciate to the effect that each portion of the mold containing one of these large sections, and with all the green sand pockets shown in cut, is rolled over twice. As the mold weights between thirteen and fourteen tons, and it has to be done smoothly and without any jar, otherwise there would likely occur something in the nature of a drop that would cause considerable loss.

The Rensselaer Co. are to be congratulated on being able to so successfully handle such work, the foundry foreman and his department coming in naturally for their share in the honors.

He used to have Charge.

Tim Ford loves to relate his exploits in far away shops to those who will listen to his yarns. With pride he swells himself out until his stomach is projected to about the size of a politicians, and then it is "when I had charge in Atlanta" or "when I used to run the Eureka" and such other tales as would indicate his bygone greatness. The boys call him down occasionally, but the other day Tim apparently had the best of them, for he produced a witness to his former splendor. A traveling member ran across Tim and was by him taken in and cared for. Jerking his thumbs across his shoulders at the guest, Tim would walk through the shop with the remarks: "This man used to work under me," or "when I had this man, etc." This became rather annoying to the boys who sneered at Tim's claims, but at present had nothing on which to base a contradiction, though an effort was soon made to verify the truth of Tim's statements. Going up to his guest one of them inquired: "Did you know Tim Ford before?" The reply was disastrous to Tim's pretensions. "Yes, he used to have charge of the cupola at Pitts."

He Overdid It.

Peter Finck is a foundry character. He has by long experience fitted himself so that he is adjustable in all positions. He does not wait for circumstances to favor him, but adapts himself to things as they come along. We have known the most hard hearted brakeman to let Finck ride and ditch the rest of the gang. We have known him to get the most delicate viands from the back door of houses that were supposed hobo proof. There is nothing recognized by Finck as an impossibility.

The other day Finck landed in Perryville and began making inquiries for a job. His informer advised him that there was a chance at Middletons, but that old man Culver wouldn't hire a man unless he appeared up to date. Above all things look intelligent, was the parting advise.

Finch proceeded to twist his features up in what he supposed was the intellectual notch and went to see Culver. The latter, after listening to Finck and sizing him up as he was striking an attitude, remarked: "I want a man pretty bad, but I don't like to hire you. Why gosh be hanged, you do look so infernal unnatural."

Working Hard.

The foreman observed Scotty, the molder, at a standstill and asked him what he was doing.

"Nothing," grunted Scotty.

A few moments later the foreman in another part of the shop ran across Mike, Scotty's helper, and asking him what he was doing, received the rather discriminating reply: "Oi am helping Scotty, sir."

Some Foundry Problems.

1. Drummer telegraphs a foundryman to meet him at depot. Foundryman complies and the drummer fills him up with 2 plates of oysters, 3 bottles champagne, 4 10-cent cigars and sends him home in a hack. The foundryman said the next day that he had a good time and it cost him nothing. Who paid the bill?

2. A was induced to purchase 1 carload cupola blocks of a poor quality. State how long he has got to stay in purgatory.

3. Alexander T. De Smith knows everything about the foundry business. Where did he serve his time?

4. A lady is a close spectator to the pouring of a large mold. It blows up. Give the length of lady's step in retreating.

5. Find the number of times a molder goes to the hydrant Monday morning.

Opening for Foundry.

Mr. C. A. Goodyear, of Tomah, Wisconsin, a town of about 2,500 inhabitants, on the C. M. & St. P. Ry., is putting up a large saw mill at that point, and thinks, so The Foundry learns from a correspondent, that it would be a good point for a machine shop, as there is none there. Mr. Goodyear would be pleased to have foundrymen looking for a new location, communicate with him on the subject.

During these last weeks of preparation, the work on the grounds of the Cotton States and International Exposition, progresses with marvelous rapidity. This is especially true in Machinery Hall, where work goes on, day and night. Big traveling derricks and cranes move steadily to and fro, on their tracks; hundreds of men are busy, day and night, putting in foundations for exhibits, moving heavy machines into place, and rounding up the work in every possible way. The first boiler was under steam last Thursday, and by this time, others are. The posts and lamp frames for the hundreds of arc lights are up, and the wiring will soon be done. Arc lights are already in use at the various buildings where work is going on at night.

In most of the buildings, the work of installing exhibits proceeds steadily. In the United States Government Building, the exhibits are almost ready for the public.

INFORMATION WANTED.

Alex Todd, of Stratford, Ont., wants some information concerning his son, Samuel Todd, who worked in Chicago the winter of 1894-95.

The National Association of Manufactures will hold their annual convention in Chicago commencing Nov. 19th.

The Wright Company, capital $25,000, has been incorporated to carry on a foundry business at Lowell, Mass.

CAST IRON NOTES.

Devoted to Inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all Inquiries to W. J. KEEP, care of The Foundry.

What are the Best Softeners.

In reply to numerous inquiries received during the past month concerning various softeners and their functions, I would reply as follows:

A pig iron is a softener simply because it will increase the silicon in a mixture. By increasing silicon iron may be softened to any desired extent. High silicon irons contain less carbon than ordinary foundry iron, and as silicon only acts through the carbon, the more carbon, the softer will be the casting. Irons that make up a mixture will not mix thoroughly when melted, and for this reason the greater the difference in the composition of the pig irons the less chance is there of obtaining castings of uniform composition. The best softener is therefore one that contains most carbon and silicon from 4 to 6 per cent; but the purchaser can never know how much carbon there is, and the best way is to order a sample car and add some to each cupola charge and notice the effect. If it reduces the shrinkage it is a good softener. It makes no difference to the user whether it has high or low carbon, or if it has high or low silicon, or anything else if it softens and lowers shrinkage. What I mean is that there is no cause to worry about what there is in a softener if it only does the work. Some softeners contain a large quantity of phosphorus. It happens that such irons are cheaper than some others on account of the cheapness of the ores from which they are made, and rival furnacemen endeavor to show that the phosphorus is a great danger to the castings, and yet they say that some phosphorus is good, because their own iron contains some phosphorus. The fact is, that it would be very difficult to find a case where there is enough in a casting to weaken it, and if this is so, a small excess in a softener of which very little is used can do no harm.

The best softener is the one that costs the least in any locality. If I lived in the south I would always use southern silvery iron. If I lived near Ohio I would buy Ohio silvery iron if it was as cheap as any other, and if I lived where a silvery iron cost much more than the cheapest No. 1 pig iron I would not buy any. The secret of buying cheap pig iron is to buy cheap silicon. If you can get enough silicon in No. 2 or No. 3 foundry to make your castings soft, you have no use for a softener. No. 1 pig iron is a softener, and No. 1 soft and No. 2 soft southern irons are both softeners, because they all three contain more than three and a quarter per cent of silicon. Silvery iron is expected to contain more than 4 per cent, and generally has 5 or 6 per cent of silicon. It is not worth while to buy iron with more silicon because it will cost more. Every founder should keep on hand a few tons of a good open, light-colored silvery iron to be used as a medicine when his castings are not as soft as he expected them to be.

Scrap is a most uncertain quantity because every separate piece has been made in a different foundry from all sorts of mixtures. Scrap must be used, and it is used with the very best results. It is always considered that the silicon in scrap is rather low, and if the larger part of a mixture is scrap, it is necessary to use enough silvery iron to make the castings soft. Whatever others may say, the best measure of silicon is to measure the shrinkage. The question is asked whether "Spathite" is a good softener. If it costs you less than any other kind it is best. This is the name of a brand of iron rather rich in silicon. Before it received its new name I used this iron and it worked perfectly as a softener. It has rather high phosphorous, but as I said before, it will not put enough into the casting to do any harm. The name of an iron is of no importance whatever, unless it has been found that the maker is at all times able to deliver iron of a uniform quality. In such case the name is a guarantee of uniformity, but the same ores will produce as good iron in any other furnace with equally careful management. For foundry purposes the cheapest iron that will make the required castings is the best. Strength is a physical quality, and is determined by the size of the grain, and not by the chemical composition of the iron. The closer you get the grain, and at the same time have the casting soft enough, the greater the strength. Scrap and close-grained pig iron will for this reason make the

strongest castings if you keep the silicon high enough to make them soft. This is the way to make strong castings for any kind of work. Keep the grain as dense as possible and add silicon enough to allow the tools to cut easily. The only way to find out how strong your iron is is to test its strength, and the best way to find whether more or less silicon is needed is to test the shrinkage. Silicon will not regulate strength, but it will regulate softness and will prevent brittleness.

Philadelphia Foundrymen's Association.

The regular monthly meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, in Philadelphia, on Wednesday, September 3, the chair being occupied by the vice-president, P. D. Wanner, of the Reading Foundry Company, Reading, Pa. Secretary Evans read a report from the executive committee. The committee reported an improvment in all branches of the iron trade throughout the country. A decided improvement was noticeable in the foundry business, castings being in larger demand. Little or no advance in prices, however, was reported. The outlook was very encouraging, and it was only a question of time when prices would advance to an extent sufficient to cover the extra cost of pig iron, coke and labor. It was the intention of the committee, the report stated, at the convention of Foundrymen, to be held in this city in November next, to make an endeavor to formulate a comparative list of prices of castings ruling in different sections of the country, as well as of the prices of labor and materials. These comparisons would, no doubt, prove very interesting and show whether the foundry business in this section of the country was as profitable as in other sections. The committee announced that they would require considerable help in providing entertainment for the visiting delegates to the convention, and members of the association would be expected to assist in the work of making the convention a success. It was proposed to hold a convention annually, and next year the meeting would probably be held in the city of Chicago, the home of the Western Foundrymen's Association, the assistance of which body had been asked for in order to issue a representative call for the convention.

Secretary Evans then read a letter received from the Western Foundrymen's Association in answer to one from this association requesting co-operation in the call for the convention, stating that the subject would be discussed at their meeting, to be held in Milwaukee on the 19th inst., and action taken in the matter.

A paper on "Contraction vs. Strength of Cast Iron," by Thos. D. West, was then read.

At the conclusion of the reading some little discussion took place. Mr. Henderson, chemist for Thos. Devlin & Co., Philadelphia, said he had found round bars most reliable and satisfactory, the surfaces being uniform. This was also the experience of Mr. Wanner. Mr. Derbyshire, of Bement, Miles & Co., Philadelphia, favored a round bar, and said it was used by his firm because it gave better results. They used both round and square bars at times, but preferred the round. Their bars were rather larger than the bars Mr. West speaks of. Mr. Glover, of Glover Bros., Frankford, said it was a long time since he had done any testing, but he had always obtained good results from a 1-inch square bar, about forty-six inches long, and with a bearing of about forty-four inches. Mr. Simpson considered a round bar most satisfactory. Mr. Stirling, of the Harlan & Hollingsworth Company, Wilmington, Del., stated that his company used a square bar as it was best adapted to style of testing machine they used.

Mr. James, chemist for Henry Disston & Sons, reported that a round test bar was used altogether at the works of his firm.

The only section of the price committee represented at the meeting was the cast iron pipe section. For this section Mr. Wanner reported that cast iron pipe had not advanced in price to any extent. It appeared to him that this was owing to overproduction. There were more foundries than the trade needed, and there not being enough work offering to keep them all filled, some were afraid of bing run out of business and so kept down prices. A good many foundries had bought iron at the lowest price ever quoted and appeared to think that they should not raise prises and have the benefit of the market advances, but should give the difference to the consumer.

"I know of one foundryman," he said, "who bought a large quantity of pig iron at $9.75, delivered at his works, and talking on the subject some time ago, I suggested to him that he had better sell the iron and not run it into pipe. He admitted I was right, but he made pipe just the same. If he had sold the iron, he could have made money." The general foundry business in Reading, he said, was very dull, and had been for some time. He could not account for the condition. The meeting then adjourned.

Foundry Costs.

A. SORGE. JR.

One of the most important matters in a foundry is the determination of the cost of the article produced. Selling prices, to be equitable, must be based upon a knowledge of all the expenditures of whatever nature which are incurred in the process of production. Uncertainty in any particular throws doubt upon all the records, affecting not only the special article under consideration, but all others that may have been made during the same period of time. In order to arrive at the required certainty it is necessary to analyze closely the cost and determine the various elements which go to make up the total. We may take it as a fundamental proposition that the cost of all articles of manufacture is made up of three general items—viz., labor, material and expenses. On the surface it appears like a simple problem to determine the amount of each of these items fairly chargeable to the particular article under consideration, but a closer examination reveals such a large diversity of kinds to different articles, that the problem becomes very complex and frequently its solution puzzles even the brightest minds. All modern manufacturing establishments employ some so-called cost system. Most of these are the results of frequent compromises with new conditions and lamentably fail to fulfill the primary requirement of reliability. The writer speaks from experience when he states that the application of close analysis to the work in some establishments will reveal a most startling state of affairs, showing losses in some directions, frequently counterbalanced by inordinate profits in others. During times of great prosperity, when prices rule high, the satisfactory total result will frequently prevent the close scrutiny necessary to discover the weak places. But during these times of business depression, when close, hard competition forces prices down to their lowest level, it will often be observed that an establishment obtains orders at prices which were apparently profitable during good times, and still the balance sheet at the end of six months or a year will show an actual loss. Such cases are not infrequent, and they show very clearly that the cost of such articles had not been carefully and accurately determined, and that these losses had been going on even during prosperous times, although not discovered on account of the overshadowing profits earned on other articles.

But cost systems are employed not only for the purpose of fixing the selling prices, but also in order to be able to compare the results of different methods of producing the same article, and for checking up the efficiency of the management of the various departments of the establishment. The latter can only be done in a satisfactory manner if the individual results of the cost system are carefully summarized and tabulated periodically, so as to be readily comparable Furthermore, these periodical summaries should be put into such shape as to make a balance sheet; in other words, they should clearly show all labor and material purchased and expenses incurred and the disposition made of them. If reliable reports or summaries of this character are obtained, then the manager or superintendent is able to make intelligent comparisons, thereby determining the advaisbility of changes whose effect is frequetly not only the improvement of certain details, but increased efficiency and greater economy in the work of the whole plant.

The great difficulty in obtaining correct and proper costs is caused by the distribution of all items thereof which are not directly visible as entering therein. The absolutely correct method would be to keep complete accounts of every possible item and not to permit the use of anything not charged at once. This would, however, involve such a mass of bookkeeping and clerical work that all possible profit would be absorbed thereby and frequently a loss

would be incurred. It is therefore advisable to analyze closely each item and to proportion all indirect labor, etc., in some equitable manner based upon accurately determined items. The items which can be obtained with greatest accuracy are the labor directly and visibly expended upon the work and the product or weight of good castings made and I therefore base the proportioning upon these two items. If this proportioning were carried out with each individual casting made it would necessitate a very large amount of clerical labor. Besides this, in a large establishment only a small percentage of individual costs is compared, because repetitions occur continually and comparisons of all would take up an unreasonable amount of time without adequate results. In order to reduce this labor and still obtain reliable results it is advisable to divide the product into two classes and to determine the proper proportion of each indirect item for each of these classes. These proportions are then applied to the individual pieces whenever it is desired to obtain an individual cost.

Such classification will naturally vary in each foundry, because the character of the product will not be the same in any two establishments. As an illustration it would be advisable for a foundry making one kind of steam engine castings exclusively to have several divisions, thus: large, medium and small; and subdivide these into classes as follows: large bed plates, medium bed plates, small bed plates; large cylinders, medium cylinders, small cylinders; large fly wheels, medium fly wheels, small fly wheels, etc. On the other hand a foundry producing a varied lot of work will naturally classify correspondingly, as for instance, into fly wheels, pulleys, gears, floor plates, boiler castings, cylinders, etc. Such classification is vital and needs close study in order to bring under each head work which shall involve in a general way a similar amount and character of labor. Its definition must also be clear and distinct from other classes, so as to avoid confusion. In all the proportioning spoken of further on in this article reference is always had to the division into classes.

Labor—Taking up the first of the three general items composing the cost we find that the labor which enters into it consists primarily of the direct labor of molders, core makers and helpers; secondly, of cleaners' time; thirdly, of general labor around the foundry, such as cleaning up, shaking out, operating cranes, mixing sand, making and repairing flasks, etc.; fourthly, cupola labor in taking care of and charging cupolas and furnaces, and fifthly, yard labor in storing and caring for flasks, materials, breaking scrap, etc. There are other kinds of labor, such as superintendence, clerical work, receiving patterns, shipping castings, running engine, etc., which will be considered and properly belong in the expense division.

The direct labor composed of the time of molders, core makers and helpers can be easily traced and recorded under proper heads. Various systems are employed for this purpose, but it is not my purpose to enter into their discussion at present. However, there are numerous cores of standard sizes employed in the foundry and these are frequently made in quantities and carried in stock, to be used as occasion requires. If the cost of each size of stock core is determined periodically, then it is easy to make the proper charge to the casting produced when the cores are used. If this is not done then the most equitable method is to distribute the cost of stock cores according to the amount of direct labor expended on the work. This may not be absolutely accurate, but experience proves that the approximation is very close. The casting cleaners' time is not easily taken directly, because the men employed are frequently of a very illiterate class, and unable to make the proper divisions in their labor. Where pickling tanks and tumbling barrels are employed numbers of pieces from different classes are treated at the same time. The proportioning of this labor depends upon the equipment and methods pursued. Where the cleaning is done in pickling tanks and tumbling barrels the charge should be proportioned among the classes according to the weight of castings, as that is the controlling element. When castings are cleaned by brushing, chipping, filing or sand blast the charge should proportioned according to the amount of direct labor expended on the molds. In the latter case the amount of cleaning labor will depend upon the intricacy of the design, and this controls the amount of direct labor expended upon it.

The general labor around the foundry is most properly proportioned according to the weights of castings. The amount of labor involved in crane operations naturally varies according to weight; handling of iron and sand the same. Cleaning up floors and shaking out, as well as cutting up and tempering of sand, demand labor in proportion to weight and bulk, which latter closely varies with the former. Repairs to flasks and making new ones will be proportioned according to the direct labor expenditures in the various classes, as the wear will depend upon the amount of handling or work done in them. The cupola and yard labor can be included with the general labor, as the amount of each involved on different classes of castings naturally increases and diminishes with the weight.

Material—The second general item is material. Here again we find a natural division into directly and indirectly consumed material. The directly consumed material consists of the iron melted and the fuel consumed during such melting, together with the flux employed. This is obtained from the daily cupola reports, which should give these amounts accurately for each charge. Periodically a balance should be drawn off showing the amount of such materials on hand, and an inventory should be made so as to check and charge up or credit discrepancies. When the work done in a foundry is of a fairly uniform character the average cost per pound of melted iron exclusive of labor can be readily determined by dividing the total cost of materials charged into the cupola in a given time, after deducting the scrap value of gates, sprues and salvage used, by the weight of castings produced. This average cost of iron is then used in determining the cost of the iron in the castings. A record should be kept of the the castings. Where the character of work in a foundry varies greatly, necessitating the use of radically different mixtures of iron, a record should be kept of the work produced from each mixture and the melted iron cost per pound of each mixture should be determined in the same manner as suggested above for an average mixture, the respective cost being then used in each case for the proper casting.

Fuel and all materials and supplies used for making and drying cores should be charged proportionately to the labor expended in the core room, as it is manifest that the materials there consumed will vary with the amount of labor consumed in working them.

Sand, flour, blacking, gaggers, chaplets, etc., in fact, all the material and supplies which are daily used in the foundry, including shovels, sieves and other tools that are worn out rapidly, should be charged according to weight of product, as the amount used depends largely upon the area and volume of the product, which vary with the weight.

Expense—The third general item is expense. This includes all items of whatever nature which do not enter into either the labor or material. Power, heat, light, superintendence, clerical help, interest on and repairs of buildings, taxes, insurance, shipping, cartage, care of and receiving patterns, depreciation of plant, etc., are included herein. The first nine items enumerated above should be proportioned according to the total labor charges, as their amount will generally depend upon the number of employes. The other items are affected more directly by the weight of the product, and should be charged accordingly.

As stated before, it is not my purpose nor is it possible to give an exact formula or rule that will be applicable to all foundries in obtaining their costs. The character of the work to be done, its amount and the facilities for accomplishing the same and handling materials will largely influence the details of the system to be employed. But it will be found on close inspection that the system of classifying the product and obtaining class costs as a preliminary to individual costs will give the most reliable results with the least amount of labor. Proper blanks with appropriately ruled and printed headings will permit the keeping of the various accounts with every little trouble. Periodically these accounts should be summarized and tabulated and inventories made of materials on hand. The tables should show totals of each item in each class, as well as costs per pound. The various items should also be figured out in percentages of the whole for each class. Comparisons should then be made and balances struck, and a general review of the results obtained will thus become available, which is of the greatest value.—Iron Age.

Keep on a Fishing.

Suppose the fish don't bite at fust,
What be yew goin' tur dew?
Chuck down yewr pole, throw out yewr bait,
An say yewr fishin's threw?
Uv course yew hain't, yewr goin' tur fish,
An' fish an' fish an' wait
Until yew's ketched yewr basket full,
An' used up all yewr bait.

Suppose success don't come at fust,
What be yew goin' tur dew?
Throw up the sponge an' kick yewrself,
An' go tur feeling blew?
Uv course yew hain't, yewr goin' tur fish,
An' bait an' bait again;
Bimeby success will bite yewr hook,
And yew will pull him in.

—Boston Sunday Courier.

The Market.

Pig iron in all grades is not only holding its own but advancing, and, as pointed out elsewhere, is liable to continue doing so for some little time yet. While the market seems quieter as we go to press than it has been, yet there is every evidence of higher prices in the near future.

The facts are as has repeatedly been pointed out, that the steadily declining market for years past has had a tendency to encourage the carrying of as little iron as possible in stock, and this, coupled with the recent severe business depression, has sent the buying movement down to a minimum amount, with the result that many producers went out of business entirely.

With improved conditions everywhere and considerable of a demand the amount of pig iron on hand has been steadily decreasing, and it is doubtful whether there is sufficient being made at this time to supply present needs. A great many furnaces and many of the largest producers have sold their entire output for the balance of the year, and all signs point to a further advance in prices.

The Iron Age, September 12, says: There has been a little less excitment during the past week and there are indications that there may be a temporary lull. While many hope and urge that there be no further advance in prices, there is a strong feeling in the trade that the end is not yet. In some directions labor is growing restive again, and it may be deemed prudent to avert any stoppage of work by granting advances in wages, in the hope that the consumer may be made to pay for it. This is particularly true of Connellsville coke, which will probably witness a rise in wages with a corresponding advance in price which furnaces will be asked to pay, strike clause or no strike clause.

NEW YORK.

Pig Iron.—Agents for northern brands have had quite a good run of orders, but decline to name prices for delivery beyond this year. Northern irons are relatively cheaper than southern brands. There has been a good deal of talk concerning the possibility of importing Bessemer pig. In common grades this is out of the question. It is possible, however, that American steel makers may cover sales of steel for future delivery by buying English hematite warrants. This can be very cheaply carried and the iron may either be shipped later on, should a further advance here warrant it, or be resold in England if that market rises in sympathy with our own. Such operations have been carried through in the past. At present pricces here and in Europe common Bessemer cannot be imported. It is different with special Bessemer, which can be laid down at $19.50. One 500-ton lot has been sold for Boston delivery, but otherwise no business has been done because foreign makers decline to guarantee the analysis of their special Bessemer. Since that is the universal custom here, buyers will not take hold. We quote as follows: Northern brands, No. 1, $14; No. 2, $13; No. 2, plain, $12.75; Gray Forge, $12.50; all tidewater delivery. Southern brands, same delivery, are quoted at $14 for No. 1, $13.50 to $13.75 for No. 2, $13 to $13.50 for No. 3, $13.50 to $14 for No. 1 Soft, $13 to $13.50 for No. 2 Soft, $12.50 to $12.75 for Foundry Forge or No. 4.

CHICAGO.

Pig Iron.—Transactions during the past week have been almost entirely confined to Southern coke and Lake Superior charcoal. A considerable amount of business has also taken place in Ohio silvery irons, to which attention has been devoted on account of the scarcity of Southern soft and silvery grades. Among the sales reported was one of 500 tons of Southern gray forge, but no sales of

foundry iron have transpired above 500 tons. The rapid advance made in Southern iron will require some little time now for consumers to make up their minds to pay the higher prices asked and a comparatively quiet period is looked for, which is expected to be followed in two or three weeks by renewed heavy buying. Southern companies are willing, to some extent, to sell for delivery running into next year, but at 50c advance on present prices. Quotations are as follows for cash:

Lake Superior Charcoal	$14.50 to $15.50
Local Coke Foundry, No. 1	.... to 14.00
Local Coke Foundry, No. 2	.... to 13.50
Local Coke Foundry, No. 3	.... to 13.00
Local Scotch, No. 1	14.00 to 14.50
Ohio Strong Softeners, No. 1	16.50 to 17.00
Southern Silvery, No. 1	15.00 to 15.50
Southern Silvery, No. 2	14.50 to 15.00
Southern Coke, No. 1	14.00 to 14.25
Southern Coke, No. 3	13.75 to 14.00
Southern Coke, No. 3	13.50 to 13.75
Southern, No. 1, Soft	14.00 to 14.25
Southern, No. 2, Soft	13.75 to 14.00
Alabama Car Wheel	17.50 to 18.00
Jackson County Silvery	15.50 to 16.00
Other Ohio Silvery	15.00 to 15.50

Fires.

Price & Evans' foundry at Chattanooga, Tenn., suffered from a small fire August 7.

Ewald Over had a fire in his foundry August 20 at Indianapolis that cost him $3,000.

A recent fire at Phillips & Clark's stove foundry in Geneva, N. Y., damaged it to the extent of $30,000.

The foundry of the Buescher Manufacturing Co., Elkhart, Ind., was destroyed by fire August 28. It was well insured. Loss, $12,000.

The foundry of Webber & Philbrook, at Waterville, Me., was totally destroyed by fire August 18. The insurance had only lapsed a few weeks previously. Loss, $30,000. They will rebuild.

American Writer Abroad.

At the recent meeting of the British Iron and Steel Institute two of America's well-known writers on the subject of Cast Iron and Cast Iron Tests, etc., were contributors. We refer to Messrs. Thomas D. West and W. J. Keep. Mr. West in the opening of his paper says:

"For the past four years the author has been studying the causes of the erratic results observed in testing the physical properties of cast iron with the object of overcoming them as far as possible."

With the foregoing as a text Mr. West recites the causes that, in his opinion, contribute to this variation, and points out what he thinks should be done to as far as possible produce greater uniformity. As Mr. West's conclusions have appeared from time to time in these columns, they are familiar to our readers. Mr. Keep's paper also is a digest of much of his recent writings, especially his papers before the recent meetings of the American Society of Mechanical Engineers. He makes, however, one or two original statements that we may refer to later on.

Among the Foundries.

Fred Hamm will build a foundry to cost $6,000 at Joplin, Md.

The Franklin Steel Casting Co., of Franklin, Pa., has been incorporated; capital, $750,000.

The Goulds Mnfg. Co., Seneca Falls, N. Y., have advanced wages 5 to 10 per cent in all departments.

The iron molders in the Russell & Erwin Manufacturing Co. plant, New Britain, Conn., have been given an increase of 10 per cent to their wages.

The Dayton Globe Iron Works, at Dayton, O., have recently received a large contract for paper mill machinery, including some immense water-wheels for a large mill owned and operated in Japan.

The S. Obemayer Co. are sending out a many-colored circular enumerating the various goods they handle. The list is a most extensive one and we believe many foundrymen would be surprised to know that so many things are needed in their business.

Although not yet a year old, the American Machine Co., Limited (Howard & Bullough), at Pawtucket, R. I., are already compelled to enlarge their modern and extensive foundry building. The new building will be parallel and adjoining the new foundry and built of brick up to bottom of windows; above that it will be of steel and glass. It will be 225x60 feet in size. Enlargements

will also be made to the core room, casting cleaning room, and an additional oven built to accommodate the dry sand and loam cylinder department.

Western Foundrymen's Association

By the time this paper reaches our readers the Western Foundrymen's Association will have held their meeting in Milwaukee, for which its enterprising secretary has been making some very elaborate preparations. It is intended that those who go from Chicago will leave via Goodrich Line steamers, September 17, arriving in Milwaukee next morning. The first session will be held in the parlors of the Plankinton Hotel Wednesday morning, when a paper by H. Hansen, entitled "False Economy in the Foundry, will be read, and another by Mr. Sorge giving "An Example of Cost Sheets for Foundries." In the afternoon the members will visit the works of the E. P. Allis Co., take an electric car ride around the city and in the evening enjoy a banquet at the Plankinton Hotel. There has been some talk of the Association holding its various meetings in different places, and this is expected to be a sort of criterion as to whether such a step is advisable.

Questions and Answers.

L. S. W. says—We have 40 or 50 tons of old steel castings, such as roll shells and mowing machine parts; also 15 or 20 tons of large blocks of cast iron, say 10 or 18 inches square by 2½ feet long. Our only means of breaking them up is to drill and break them open so that we can crack them up under our drop. It is our impression that it would pay us to build a sort of reverberatory furnace making a short cut; or, in other words, a less expensive appliance than a regular reverberatory furnace. This could be small, and would have to have an opening in the top large enough for us to lower our blocks of cast-iron into it without trouble. Now this matter is further complicated by our desire to get rid of this 50 tons of steel castings; there is some wrought iron in it, not a great deal, however, and it is our impression that if we can mix up our big blocks of cast-iron with the steel castings, and perhaps a little wrought iron, we may get something of some value, that we can tap off into sash weights, floor plates, or something of the kind.

Can you give me, through your columns, any other plan of melting brass other than in cupolas? Does it injure the brass to melt it in cupola? R. C. P.

Is it possible for blow holes in castings to be caused by some quality of the pig-iron from which they are made, or may they arise from improper melting our pouring, or must we necessarily look for their cause in the molds or cores? Very respectfully,

J. C. GREEN.

E. M. R. asks: Is coke the proper material to use in venting large molds. Is there sufficient heat arising from a large casting to decompose the coke, thus causing a gas to rise that would fill the vents made and prevent gas from the interior of mold from escaping?

The Whiting Foundry Equipment Company, Harvey, Ills., are mailing to their customers their new thirty-two-page catalogue, devoted exclusively to foundry cranes. It is neatly printed in colors, with half-tone engravings, and is probably the neatest and most complete article of its kind ever published.

And now comes the Gobeille Pattern Co., Clere, Ohio, once again with another original "Gobeille" remainder. This time it is simply a piece of bark, four inches long, two inches wide, upon which is neatly printed the following: "A fierce BARK often precedes a toothless bite. While our competitors are barking, we are doing the business." As we have had occasion to before point out, it can be easily understood, if their patterns are anything like as artistic, neat and original as their occasionel reminders.

A few weeks ago, a man, rendered desperate by hunger, broke into a North Side bakery and stole two loaves of bread, for which he was promptly arrested and sent to the bridewell. Last week, it was ascertained that certain wealthy packers at the stock yards had long been stealing the city water. The amount of the thefts, while it can never be definitely ascertained, is simply enormous, the present estimates placing the aggregate at over 40,000,000 gallons per day. The Union Stock Yards and Transit Company, a corporation of immense wealth, has been doing the same thing. These enterprising companies apologize for the theft

and state that the fact was unknown to any of their officials or managers. Certain wicked workmen, anxious to aid the good work of swelling the already fat dividends of the various companies, made the connections, stole the water, and, very descreetly, said nothing about it. Of course it is not expected that any one will believe these fairy stories. We ought to be consistent, however. Either release the poor man who stole the bread, or send these wealthy thieves to help him break stone.—Journal of Commerce.

The Lansing Wheelbarrow Co., Lansing, Mich., sends us their very large and complete catalogue and price list. We were especially interested in and noted with pleasure the extensive line of wheelbarrows, trucks, charging barrows and cars intended for foundry use made by them. Evidently there is nothing in that line they do not manufacture and keep on hand.

Deaths.

Geo. J. Fritz, proprietor of the Fritz Machine Works, St. Louis, Mo., died there August 5th, at the age of 49.

Major August Ledig, proprietor of a brass foundry in Philadelphia, died at his home there, August 12th.

Philo S. Curtis, one of the principle citizens of Utica, N. Y., and proprietor of the iron foundry bearing his name, died there August 12th.

John McNeal, the founder of the McNeal Pipe and Foundry Co. at Burlington, N. J., died at his home there August 18th, aged 87.

The Foundry Extends its Congratulations.

The Machinery Molders' Journal is undoubtedly the oldest foundry publication in the world, having been established in January, 1888.

Recently some arrangements have been made whereby it will be enabled to extend its sphere of usefulness, and commencing with the last August issue, it has been enlarged and otherwise improved. W. E. Wilkes will continue to guide its destines, and The Foundry sincerely wishes prosperity to all interested.

N. N. Hill's foundry at East Hampton, Mt., is nearly completed.

Potter & Hollis Foundry Co. at Chicago. Capital stock $10,600.

Palmer Bros. are building a new foundry at Belle Plain, Iowa.

The Columbus Stove and Range Co. is a new concern to locate at Cicero, Ind. Capital $25,000.

King's Hand-book of New York is the title of a large volume containing over 1,000 pages and over 1,000 artistic half-tone engravings, all devoted to the task of describing the Metropolis of America.

It is printed on fine paper, handsomely bound and its views of many of the well-known sights in Gotham alone make it well worth the subscription price, $2. Moses King, Boston, is the publisher.

The Lunsford Foundry and Machine Co., built at Atalla, Ala several years ago and never operated, have commenced work. The Attala Foundry and Machine Co. shut down some time ago, will also resume operations.

Lee, Chamberlin & Co., of St. Louis, Mo., sent us a handsomely illustrated book of over 20 pages, describing the development of the Connellsville coke region and the advantages of coke over other kinds of fuel for cupola melting.

Rather Lose than Quit.

That was a rather amusing circumstance related by Mr. Wanner at the last meeting of the Philadelphia Foundrymen's Associa- as showing a side of human nature that we fear is only too often displayed these days. A certain pipe foundryman had purchased a large amount of pig iron at the prices ruling early in the year when some grades sold down near $9 per ton. Afterwards he took an order for a large amount of heavy water pipe at a price that would have netted him less per ton than a re-sale of his pig iron would have brought him.

Surely the desire for competition or the craving for orders at any price must amount almost to a mania with some people.

Evidently the much talked of understand-

ing between the pipe founders of the country that it was expected would do away with this cut throat price cutting has not yet materialized.

Notice

Advertisements Entitled Situations Wanted, or Situations Vacant Will be inserted in this column one insertion FREE. All others 25 cents per line.

WANTED—A molder and patternmaker as partners in a foundry in St. Louis, Mo. Light capital required. Address Foundry, Third and Pope N., St. Louis, Mo.

WANTED—Position as foreman, superintendent or manager of foundry. Twenty-five years' experience on all classes of gray iron casting; 15 years' experience in above positionsQ. References. Correspondence solicited. Address N. E., care of Foundry.

WANTED—To sell one-quarter or one-third interest in foundry and machine works to practical molder, who can take charge of and operate that part of the business; $1,000 cash, balance in installments. H. H. Mason, Mt. Carmel, Ill.

FOR SALE OR RENT—A foundry, 20x56; everything complete and ready for business in a good locality. Has a good trade now. Splendid chance for the right man. Terms easy. Address Box 619, Owatonna, Minn.

FOREMAN WANTED in malleable iron foundry; must understand how to handle men to best advantage and be able to produce high grade iron at low cost. Address Malleable Iron, Ct., The Foundry.

FOR SALE OR RENT—Foundry plant in complete running order; buildings and machinery practically new. One and one-half acres of ground with switch from railroad. Also for sale, one iron column lathe; takes in 21-foot columns and turns both ends at the same time. In good order. Address C. RUSSELL, 1155 S. Paulina st., Chicago, Ill.

FOUNDRY and machine shop for sale, cheap. Wishing to retire from active business, I offer my entire plant at a great bargain. The plant consists of a machine shop 36x60 feet, 3 stories high, with complete set or iron and wood-working tools and machinery; foundry 60x80 feet, with first-class equipment; fire-proof pattern building, 30x30 feet, 3 stories high, containing a large stock of very desirable patterns; also blacksmith shop, storehouse, japaning building and office building. Both steam and water power. Just the plant for manufacturing hardware specialties. Address Huntington Beard, Fayettville, N. Y.

To Make a Bad Casting Good.

Our attention has been called to a new cement for the use of iron founders advertised in this issue. Often a defect in a casting does not impair its strength while the fault spoils its appearance.

This compound remedies the defect by filling it with a composition that becomes hard as iron and about the same density. It is applied at the normal temperature of the casting, and there is no unequal expansion or contraction upon the application of heat. It will stop a hole in a casting steam tight and will often save a hundred times its cost in time and labor.

It seems to us that a cement such as this, is something that should be in every foundry in the land.

Formulas for Casting Commutator Bars.

No. 1:

100 lbs. copper.
1 lb. oxide of manganese.

Note—Melt oxide of manganese with copper and before pouring fuse in a 2 oz. stick of phosphorus. Pour hot, use coarse sand for molds.

No. 2:

100 lbs. copper.
¾ oz. cryolite.

Note—Fuse in a 2 oz. stick of phosphorus. After melting the copper put in cryolite first then phorphorus.

Dip castings in acid of vinegar, while hot, as soon as congealed.

Note—Phosphorus should be infused in metal by means of a graphite rod which has a 5-8 inch hole extending in one end 6 inches or 8 inches. The stick of phosphorus to be placed in the hole and held there by means of a strip of copper on end.

Pokey's Pointers.

"Tell Tom Bowers to step up here," said Mr. Pokey to one of the cubs in the machine shop.

"Mr. Pokey wants to see you," was the message delivered to the foundry foreman a few minutes later by the cub, who as soon as the foreman had left the foundry took advantage of his absence and fired a ball of greasy waste at one of the coming molders, who had on a previous occasion made him the present of a ball of sand in the neck.

"Tom," said Pokey, when the former appeared at the office, "do you know there are leaks in the foundry?"

"I do that," promptly responded Tom. "I spoke to you about them two months ago. Only the other night during that heavy storm Bill Davis had a mold he had worked on two days entirely ruined by the water pouring right down on it, a barrel of plumbago——"

"Not that kind of leaks, Tom, you don't understand me. I mean leaks where the money goes right out and you have nothing to show for it."

"Well I should say Mr. Pokey that considerable money has already escaped through those leaks I spoke of, and we have nothing to show for it either."

"I tell you Tom," rejoined Pokey, "it will tax the capacity of your mind to comprehend the full importance of what I have just discovered or rather what has just been brought to my notice. Those leaks you speak of are insignificant when compared with the one to which I am about to call your attention. Why, Tom, a great deal of our money has just been oozing away, ever since we started, all the while Father ran the shop it has just been dripling, but I am going to get it back, every bit of it. You ought to have noticed this before, but I can't blame you much for your education was neglected in your youth. Tom, do you save all the iron that is wasted from day to day, and commonly called shot."

"Well," said Tom as he decorated part of the floor in a vain attempt to reach the cuspidore. "We do, most of it, what won't go through a number four, what is wasted don't amount to anything."

"Don't amount to anything Tom. I am surprised to hear you talk that way. Shot is iron, ain't it? Iron is money ain't it? Here Tom is money being wheeled out to the dump before your very nose, every shovelful of refuse contains more or less, and still you say it don't amount to much."

"Let me tell you," said Tom as he nursed a sore finger he had acquired while showing a molder the proper way to drive a wedge. "Shot ain't of much account, not to us anyhow. We have got to furnish castings that are to be finished a great deal, and an over charge of this would cost us a dozen times more than the shot is worth. If we had a different—"

"Who said to overcharge it," interrupted Pokey. "Shot is iron, iron is money and with this he gave a significant wink at the typewriter continuing. "Here Tom is a book called 'How to Make Money in the Foundry,' it is an advertisement for a machine that by the aid of a strong magnet saves all the small particles of metal. All we got to do is to have the refuse from the foundry passed through it, it will pick out the iron every time, it costs five hundred dollars, but Tom it can't help but pay. You get a winning hand every time the cards are dealt. There is no such a thing as to lose. Here is a long list of foundries using them and having the best of us. I have so much to tend to that I neglect the foundry, but when I see a good thing I know it. The book says that nearly all of the iron usually counted as lost in melting can, by this process, be recovered. About how much has been our general loss that way Tom?"

"About 2 per cent, sir."

"Just think of it Tom, and then you say it don't amount to much. Where were you raised anyhow, Tom. As I said before, you ought to have known this long ago, but I can't blame you for not having inherited a taste for figures. You ought to practice a bit Tom, there is money in it. Anyway we can't run the way we are, of course we have always made money, but our reputation has got a great deal to do with that. I am going to order that magnetic shot picker at once, clear away some of those flasks in the shed to make room for it."

"I will have to put them outside, no other place, and it is liable to go hard on them, Mr. Pokey. Wooden flasks don't live long when exposed to the elements."

"Never mind Tom, shove them out, we have got to stop some of those leaks that

are draining our money box. We can't afford to let iron be thrown away. I have thought for a long time that something was wrong, but not until now have I had my eyes opened. Why I can see clearly how competitors get the upper hand of us. Don't let them wheel anymore dirt out, let them make a pile of it close to the shed 'til we get the machine.

* * * * * * * * * *

The boys all agreed that something was wrong with Tom. Some said he was mad because he had to hire the family washing done; others that he was downhearted because the frost spoiled his strawberries.

"Well, how is the machine working," asked Pokey on one of his strolls around the shop.

"All right," said Tom.

"Well now Tom," continued Pokey, "let this forever be a lesson to you. You see now how we have actually been throwing money away, mighty good thing we didn't sell those lots last spring, we have got a chance to go over that dump, and by the eternal it is going to be done too. Of course I have got so many things to tend to outside of the foundry, but I am going to pay more attention to it hereafter, and bring it above the standard. Your principles are good in many things Tom, you mean to do the best, but you know you haven't been away much of late years, ain't had a chance to see what other people are doing, so you see some of your ideas are apt to be behind, but I have full confidence in you, you mean to do well, and there shall be no hard feeling between us because some shot has been wasted for several years. My gracious, Tom, what is this?"

"That," said Tom with impressive solemnity, "is a load of castings returned from Soper & Co."

"What is the matter with them, never knew this to happen before," said Pokey as he stepped closer to the pile to get a better look at it. "Don't see nothing wrong, looks like nice castings the same as usual."

"They won't finish up clean," began Tom, "the trouble lays in using that fine shot, and such an amount of it as you want to."

"Well, shot is iron, ain't it?"

"Yes, shot is iron, but that does not say that it is the kind we want to use, if we were making sash weights, grate bars or something on which no machine work was to be done, we could get rid of all we wanted to, but before you can understand why shot iron will spoil the chances for a clean finish, I must explain how this is done."

"Make it short, I have got to meet Ed. Scott at the city hall by eleven."

"You know it is shoveled into the cupola along with the fuel. In charging the larger pieces of iron they are kept for a considerable time in the part of the fuel where combustion is taking place, what we call the melting point, they are kept there because they can't get through only as fast as they are melted. Now the small shot comes sliding down in the same way, but a large number of these little pellets find nothing to obstruct their downward course and fall into the bed of melted metal at the bottom of the cupola, without having remained at the melting point until melted, and without having the heat imparted to them necessary to become fluid. If your body of melted iron at the bottom of the cupola is not melted extraordinary hot, these shot retain nearly their original form, and are tapped out, part of the iron being thus fluid and part solid. The solids are these little specks you see where it looks like a small ball has taken a rest, that is the shot."

"I can't repeat what you have said Tom, but I guess you will get the shot close enough with your No. 4. But I wish you would have said something about this before, it would have saved us money, Tom, but I can't blame you much, you didn't have no show when you were growing up."

"I tried to tell you when you called me in the office," said Tom.

"Yes, I remember, but not so that I could see through it, it weren't plain enough, however your principle is good. You mean to do well. This won't break us, we have always made money, thanks to our reputation, but I have arrived at a few conclusions, they are:

That the best way to get rid of shot is not to make it.

That it sometimes costs more to stop a waste than what you save.

That to strive for things that are useless to us we are apt to open our pocketbook to the wrong party.

That shot is bad.

I think I will remember that because I have paid for the information, and we always retain the best impression of that we pay the highest price for. Well, Tom, do the

best you can, I have always too much to tend to. I am going to raise the price of those lots a hundred dollars apiece to make up for this. Slip the belt off that machine and put the flasks back in the shed, and say Tom, I will send a man down to fix that roof. I believe it will pay to stop those leaks."

(To be continued.)

*Malleable Cast Iron.

Its Manufacture and its Properties.

H. R. STANFORD.

If any systematic and scientific study has been made of malleable cast iron the results have been very carefully kept private. The reason for the apparent neglect may be that until recently only very unimportant shapes, as far as strength and uniformity were concerned, were made by the process, and specifications and inspections were not needed. The late extensive use of malleable cast iron in the master car builders' vertical plane coupler required the metal in a form in which it was subjected to a very hard and uncertain usage, and where failure to withstand that usage might result in serious loss of life as well as property. The importance of quality in the casting led to the drop test being inserted in the master car buliders' specifications, and malleable cast iron was first subjected to test treatment. In the hope of arousing ideas and discussions on this by no means simple and unimportant industry the following methods and opinions are submitted:

Malleable cast iron is made principally from charcoal pig iron and a percentage of scrap or sprue sufficient to use the culled work, gates, runners and shrinkers that may result from the continued application of the process. After analyzing a number of kinds of pig iron, the author was led to believe that coke pig iron might just as well be used as charcoal pig, and developments have fully justified the assumption. The main difference between charcoal and coke pig iron is in the percentage of sulphur and in the cost; but if a good quality of coke is used the sulphur is not high enough in the coke iron to affect its use.

*A paper read before the American Society of Civil Engineers.

Sprue amounts to from 20 per cent in heats for coupler or heavy work to 40 to 50 per cent in light carriage work. An addition of 4 per cent of heavy annealed scrap was introduced very successfully into all charges, and a large accumulation of the cheap and undesirable iron was disposed of. As much as 18 per cent of annealed and broken couplers was tried experimentally in a charge for a coupler heat, and the resulting material was excellent, as far as quality was concerned, but the surfaces were not smooth and gave an impression of pock marks. As annealed scrap can be secured at $4 a ton, and as a great many will take no exception to a rough looking casting if of good quality, it seems as though there might be a use for the piles of broken couplers which a day's ride can hardly help revealing.

THE MELTING FURNACES.

The furnaces used in melting malleable cast iron are cupolas and open hearth furnaces. The open hearth furnaces which the author has used are of two types, a straight forced draft furnace, using a good, hard, close, bituminous coal as a fuel, with an air pressure of 4 or 5 ounces, and a Siemens-Martin furnace, using oil as a fuel. Fig. 1 shows sketches of the straight draft furnace. In this furnace the fire was entirely drawn after the day's heats, and with no repairs could be used about three days. After three days the bottom needed a little fixing and the sides a little plaster, requiring an hour or two for the work. A renewal of some of the brick work was necessary about every six months. A charge of 6 tons would be ready to tap three and one-quarter hours from the time it was charged. The consumption of fuel depended on the number of tons a day melted, a certain amount of coal being necessary to heat the furnace for the first charge, whether 9 or 20 tons were melted. If 9 tons were melted the coal consumed amounted to 0.6 pounds per pound of iron, and if 20 tons, to 0.45 pound per pound. The furnace loss was about 4 per cent of the charge. Two men were needed to operate the furnace, the melter and the fireman; and four additional men were needed for about 15 minutes for charging each 5-ton heat. The Siemens-Martin furnace, with oil as a fuel, was of the nature of an experiment. The furnace had a capacity of about 8 tons, and was equipped

with three oil burners at each end. As operated practically—that is, fired hard for 12 hours—the consumption of oil was 450 gallons in 24 hours. The checkers were used only for heating the air which was used in addition to that for atomizing the oil. Air was found far superior to steam as an atomizing agent, and was supplied by a conpressor working under an accumulator pressure of about 60 pounds. At times there was considerable water in the air as delivered at the burners, and to convert that water into superheated steam, rather than to heat the atomizing air, the air blast was conducted

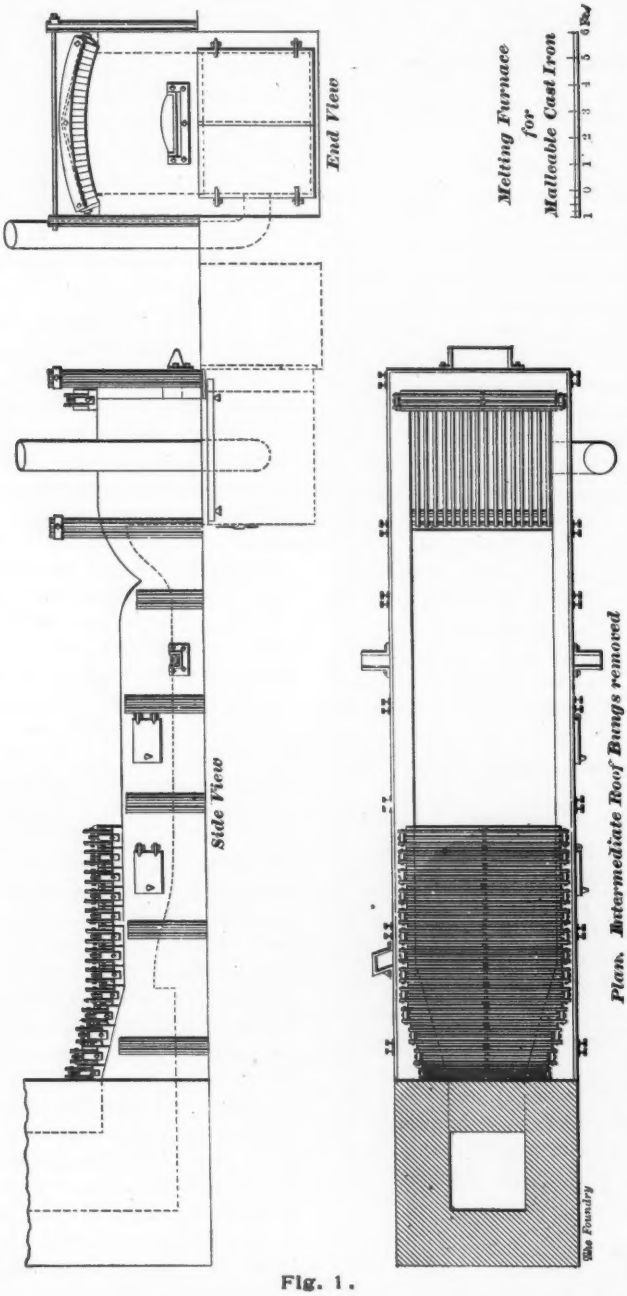


Fig. 1.

through a hot coil just before reaching the furnace. Oil, even when burned with an excess of air, seems to decarburize the charge very little, differing in this respect very materially from producer gas. The advantage of the oil furnace was in the saving of fuel cost (which saving is, of course, a function of location of plant), in having no ashes or refuse to deal with, and in having a furnace which could be used to suit the convenience of the molders without a corresponding fuel and attendance loss. The great disadvantage—which might be overcome by additional experience—was that the checkers became clogged too soon and too much time was required for cooling down, cleaning and reheating. The labor to operate amounted to about 25 per cent more than was required to operate the coal furnace. The furnace loss amounted to 5 per cent.

The manipulation of the charge in the oil furnace was practically the same as in the coal furnace, and the times for melting and heating were also nearly the same. About one hour and a half was required to melt completely 6 tons, the solid masses being shifted to hurry the melting. After the charge was melted it was frequently rabbled and the surface skimmed clean of all slag after the first good rabbling. Just before tapping a second skimming was made. Two tests were made before tapping a charge, the first to see if the iron was "high enough"—that is, to see if in the heaviest form into which it was to be poured the carbon would be practically all in the combined state. The determination for a charge for ordinary heavy castings was made by dipping out a little of the iron and pouring a bar about 4 inches long and 1 inch in diameter, and after it had set cooling it carefully in water. If cooled too rapidly the shrinkage was such that nothing could be told by the fracture, but if properly handled in four minutes from the time of dipping out the iron the bar could be cast, cooled and broken. If the iron was "high enough" the fracture would be entirely white, but if not there would be little spots of graphite about the size of the head of a small pin, and more or less numerous, depending upon whether the iron needed much more or little time in the furnace. The second test was for fluidity and was made entirely by eye, using blue spectacles for protection. If thin enough the iron was a clear white, but if not it had a kind of dark hue not easily described. If the charge was intended for car couplers or other very heavy work the test bar would be larger, or about 1⅜ inches in diameter. To secure thorough mixing in the furnace and to heat the hand ladles of the molders the first ladleful drawn by each molder was returned to the furnace through a side trough, but notwithstanding the precaution the mixing was very imperfect.

The cupola was used very advantageously in connection with the open hearth furnace. It was used for the lightest patterns and for patterns where a uniformly superior metal was not of vital importance, and for the shapes in which a considerable shrinkage would not destroy all strength. The lightest patterns were placed under the cupola because the fluidity of the cupola metal was greater than that of furnace metal, due to the higher percentage of carbon which resulted from the contact of the iron with the coke fuel. Ordinarily, if the charge is properly introduced, the quality of the product is very good, but at times the iron is not mixed in going down the cupola and gray castings result. The high temperature of the iron and the excessive hardness which was necessary to avoid gray iron in the heavier shapes made the shrinkage of cupola iron destructive to some forms, as, for instance, a corner iron. In the cupola a much larger percentage of sprue could be used than in the furnace, because of the recarburizing tendency of the fuel. A high percentage of carbon in the iron is necessary for fluidity and clean castings, and on the hearth the bath loses rather than gains carbon. Coke was used for fuel, and a small quantity of oyster shells or lime served to clean the iron and keep the cupola free from slag. About ⅛ pound of coke was used in melting 1 pound of iron.

For small work hand ladles with a capacity of about 40 pounds were used. Hard iron, if at the proper temperature for small work, scintillates brightly when tapped, differing from the more globular sputtering of gray iron.

Green sand, with a mixture of plumbago and cement for a facing, was used for molds. Most small shapes were cast with several pieces on a gate, and the pieces were so lightly attached to the runner that a slight blow was sufficient to detach them. Ma-

chines were advantageously used for making most molds.

Depending upon the form of the castings, they were next either tumbled or pickled. If the tumblers were filled properly it was surprising to see the delicate shapes that stood the treatment without breaking. The pickle was a very dilute sulphuric acid, which was poured over the castings, and after being allowed to stand for a short time was removed, together with the loosened sand, by a water bath. The hard castings were then

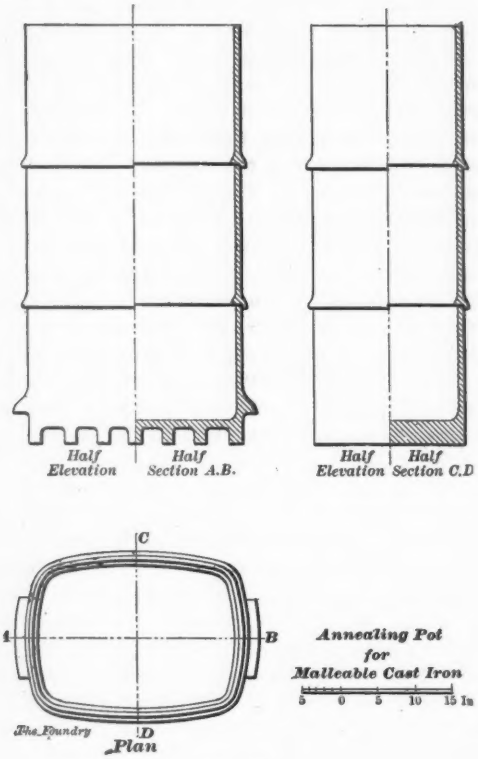


Fig. 2.

inspected and the good ones chipped of fins and gate connections.

PACKING AND ANNEALING.

After chipping and sorting the iron was taken to the packing room, where it was packed in pots for the annealing process. In order to avoid distortion or crooked work and to get as much as possible in a pot considerable care had to be exercised in the packing. Although the pots were jarred and the packing consolidated as much as possible there was always a further settling as the result of the heat in the annealing oven, and such a shape as a rim band for a buggy wheel, if placed with its axis horizontal, would be flattened to an eliptical form; whereas, if packed with its axis vertical the band would settle with the packing and would not be distorted. Clean, heavy forge scales seem to make the best packing, everything considered.

According to all accounts of the manufacture of the malleable cast iron which the author has been able to find the packing must be an oxide of iron scale or some compound which, because of its chemical composition, with a certain degree of heat, can exercise a decarburizing influence upon the castings which it surrounds and so change the casting from a high carbon iron to a carbonless or wrought iron. The author's opinion is that the packing need not be necessarily a decarburizing agent, but that it should be of such a physical form that it will readily fill all small interstices between castings; that it should not fuse or slag under the temperature needed for annealing; that it should not adhere strongly to the castings or form into hard lumps, increasing the cost of dumping and of tempering the packing, and that it should not be too expensive. That good malleable cast iron is not a carbonless iron. An effort to anneal a brake shoe, so that the surface would be part hard and part soft, led to some specially prepared pots in which black oxide of manganese, clean river sand and sand mixed with a large proportion of ferro-cyanide of potassium were used respectively. In every case the iron was as soft and malleable as it could possibly have been by any treatment. A sprinkling of powdered quicklime, after the packing has been tumbled and raked and moistened a little with a solution of sal ammonia, makes it less liable to pack hard in the burning and renders the dumping of the pots much easier. Riddling out the small particles of dirt and scale does not benefit the packing.

Pots were best made for convenience and economy in three sections, as seen in Fig. 2. A pot with a capacity of 800 pounds of iron weighed 750 pounds, and lasted for about five heats of five days each. Each heat produced a heavy scale all over the outside of the pot, which was easily knocked off after the pot had cooled, but limited its life. Before the pots were run into the oven, in order

to keep the oven gases from entering them, the joints were plastered with a fire clay mortar. To protect the pots against the waste caused by scaling, heavy coats of lime, of cement, of fire clay and of an asbestos cement were successfully tried, but without success. The lime seemed to be the best protector, but the pots scaled under it so much as to make the labor of applying the whitewash an expense rather than a saving. A loaded pot weighed about 1 ton, and was handled by six men with a carriage.

THE ANNEALING OVEN.

Oil was superior to coal as a fuel for the annealing oven, not so much from the standpoint of economy as because of its controllability and cleanliness. Low pressure air from a Root blower atomizes the oil satisfactory, and 100 gallons of oil per burner per day was about the consumption. Fig. 3 shows sketches of an annealing oven. The temperature maintained was a bright cherry, and was determined by the eye through peep holes. Too high a temperature wasted the pots needlessly, burned the packing hard and neither hastened nor improved the annealing of the iron. The time required to anneal iron varied more or less chemical composition than from the size or thickness of the piece, and ranged from three to ten days, including the time necessary to raise the heat and cool the pots.

Combustion of the fuel in the annealing ovens should not be completed in the fire hole, but by properly manipulating the chimney draft and the air supply the mixed air and gas should slowly drift through the oven and combine as they come in contact with the red hot pots. Uniformity of temperature throughout the oven is to be obtained only when the conditions are such that fuel gas is burned in all spaces in the inclosure.

As illustrating the above point, the effort may be cited to economize fuel in annealing by doing away with the murkiness which characterized the gases as they emerged from the fire hole of an operating oven, but which, the projectors of the experiment failed to notice, nearly all disappeared before reaching the chimney inlet. The murkiness was rightly attributed to incomplete combustion in the fire hole, and the argument at the base of the experiment was that if the air used for atomizing the oil was heated, instead of being injected into the oven cold, the resulting temperature in the fire hole would be higher, and a larger part of the mixed fuel gas and air would combine and the amount of smoke in the issuing gases would be decreased, with a corre-

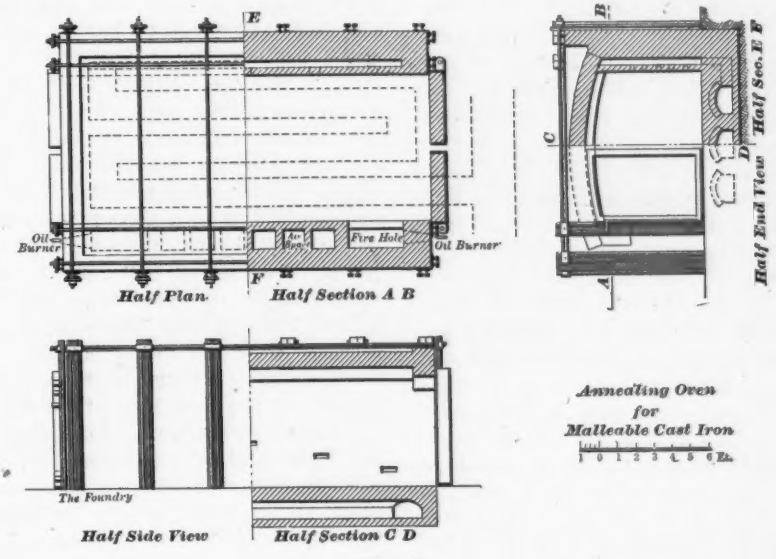


Fig. 3.

sponding saving in fuel. By means of a coil placed in the chimney the atomizing air was heated to a temperature of several hundred degrees by means of the waste heat of the chimney. The device was introduced into one of two ovens, precisely alike in all other respects, and located side by side, loaded with the same kind of iron packed and placed in the same way. The oven heated with a smoky fire completed the work in four and one-half days, while in the other oven the oil valve had to be opened wider and six and one-half days were needed to anneal the iron farthest removed from the fire hole, while the iron in the pots next to the fire hole was badly burned.

The effect of composition on the time of annealing will be noticed later. A softer metal was obtained if the oven doors were allowed to remain closed for at least one day after the firing was stopped, and the scaling of the pots was much diminished. A day was sufficient to cool the pots with their contents to a black heat. Sometimes iron was packed in one large mass or bed, filling a part or the whole of the oven. The method effected a saving of pots, and cost no more in labor for packing, but was at a great disadvantage in time required to anneal the work thoroughly, in labor for unpacking and in the percentage of distorted pieces. A grade of iron requiring five days to anneal if packed in pots would require seven days if placed in a bed. A per pound estimate of the productive cost of annealing iron, based on an oven heated by two oil burners and with a capacity of 30 pots, each loaded with 800 pounds of iron, is as follows:

	Cent.
Labor packing pots	0.0117
Labor loading oven	.0025
Fuel (including air for atomizing and attendance	.0938
Labor unloading oven	.0025
Labor dumping pots and picking out the iron	.0104
Labor tempering and handling packing	.0083
Pots	.1000
Scale for packing	.0208
Total	0.2500

After being annealed the freshly dumped iron has a rich blue color, which is probably given by a thin scale, and is entirely lost in the tumbling that constitutes the last step in the process for making malleable cast iron. Upon the use which is to be made of the iron depends the details of the final process. For shapes where appearance is of little importance, a rough tumbling for a short time is sufficient. For pieces, such as handles and buggy trimmings, which are placed in conspicuous positions and are sometimes tinned or nickle plated, a further treatment is necessary. After the rough tumbling follows a wet tumbling, in tumblers through which a current of water is running, which thoroughly cleanses the surfaces, and finally a dry polishing tumbling with pieces of leather.

CARBON.

Next to iron the most important element in malleable cast iron is carbon. A high percentage of carbon is necessary for fluidity, and fluidity is of prime importance, not only that the percentage of lost molds may be small, but that the iron may run clean and smooth, and the resulting work have a perfect surface. For strength and malleability the unannealed castings must have no graphitic carbon, but the total percentage must be in the combined state. With a given molten iron at a certain temperature, if the iron be poured into a mold of a certain section the casting will contain all of the carbon in the combined state and the fracture of the annealed specimen will be of a uniform dark fibrous appearance. If the mold be of a smaller section the casting made from the same iron will show the total percentage of carbon as combined carbon, but there will be a surface chill, which in the annealed specimen will shine as a white skin. If the mold be of a greater section, then the rate of cooling of the iron will be so slow that a lot of the carbon will have time to separate from the iron graphitic carbon, and will show in the fractured unannealed casting as scattered spots of graphite about as large as the head of a small pin, the number of the spots increasing with the section of the casting. The above three castings, if annealed , will show the following physical properties: The first will have an ultimate strength of 42,000 to 46,000 pounds, and will stretch and reduce about 6 per cent, and may be considered a most desirable iron. The second will show in fracture a white crystalline skin, increasing in thickness as the section is lighter, and with a black fibrous center; the ultimate strength will be about 52,000 pounds, and the stretch and reduction about 3.5 per cent; if

the section is so light that the whole fracture is white, then the iron will be very malleable and tough. The third casting will be little better than gray iron, with a strength of from 25,000 to 35,000 pounds, depending upon the percentages of graphite in the unannealed iron, and with practically no stretch or reduction.

The chemical action in the furnace seems to be primarily the combining of the graphitic carbon of the charge with the iron, a combination made possible in the fused mass by the temperature; and secondarily a small burning out of carbon and slagging out of silicon and manganese. The secret of mixing is in using material containing combined and graphitic carbon in such proportions that at the temperature best adapted for pouring the graphitic carbon shall all have combined with the iron. To assist in preventing chilling in the mold, a limited amount of silicon is desirable. A chill is objectionable because in one piece there will be two different kinds of iron which have different physical properties and which do not act the same in service. Either kind of iron by itself would be stronger than in combination with the other. Chemical action involves atoms; therefore if all carbon exists in the combined state in the annealed iron, it must be distributed through the mass in infinitesimally small particles, and when these particles are liberated from the iron in the subsequent process of annealing they must each be inclosed in an iron cell. Hence the definition might be given for malleable cast iron that it is essentially a mixture of metallic iron and graphite carbon, the carbon being in finely divided or atomic particles and the iron being the matrix for these particles. Gray iron differs from malleable cast iron in that the carbon instead of being in atomic particles, is in crystals, and these crystals cut the iron structure and make it discontinuous. In malleable cast iron the continuous cellular iron structure is responsible for the strength of the product, and its malleability and ductility are limited by the non-reformable particles of graphite which occupy the cells. The process of making malleable cast iron is then first to make the hard, brittle carbide of iron which is a stable compound at ordinary temperature. This step is possible because of the affinity of iron for carbon at high temperatures and the inability of the carbon to separate from the iron in the limited time required for the compound to cool in molds; and secondly, to change the carbon from the combined to the graphitic state by annealing. This step is possible because of the inability of the iron to hold carbon in combination if the compound is slowly cooled from a high to a low temperature.

Shrinkage is a function of casting temperature, and the nearer the iron is to the gray state and yet shows no graphite in fracture the less will be the shrinkage. The normal shrinkage of hard iron is very nearly ¼ inch to the foot, and there is an expansion of about ⅛ inch to the foot as the effect of the annealing process, so that the net shrinkage is about ⅛ inch to the foot, or about the same as for gray iron. Inasmuch as shrinkage depends upon the condition of the carbon, and the condition of the carbon depends upon the section of the molds, and because abnormal shrinkage is so undesirable, the necessity arises for different mixtures for different patterns. The shrinkage of cupola iron prohibits its use for a great many shapes, because of the imperfect mixing that necessarily characterizes cupola melting, and because of the factor of safety required in the charge to be sure of avoiding gray iron in the castings.

SULPHUR.

After carbon, sulphur is the next important element in malleable cast iron. Sulphur tends to hold the carbon in combination with the iron and gives a stronger product because of a semi-steel which it produces. Sulphur is undesirable because of the hindrance it offers to annealing. The shapes ordinarily made by this process need not have great strength, but it is desirable that they be soft and capable of bending, and that the time of manufacture and cost be as low as possible. To show how sulphur affects the time necessary to anneal, couplers which analyzed about 0.040 per cent in sulphur, and in which were sections about 1½ inches thick, were thoroughly annealed in 3½ days, while iron bands for buggy wheels, which were no more than 3-16 inch thick and analyzed about 0.150 per cent in sulphur, were invariably hard if given less than five days. If sulphur is carried as high as 0,200 per cent, enough carbon is retained in the combined state to give to fractures a uniform crystal-

line appearance, and the method is employed to make a so-called hard or special steel. This product in ordinary sections does not anneal in less than nine days. Special pains should be taken when buying coke for cupola melting to get a coke low in sulphur, as the iron coming in contact with the fuel picks up sulphur and delay in the annealing process, with the accompanying wastes, is the result.

The results obtained are not sufficiently numerous and uniform to warrant any general conclusions regarding the effect of manganese and phosphorus further than to say that phosphorus seems to be a very passive element and anything but the bugbear which it is in steel. A limited period of anneal might be considered as giving better results than an indefinitely longer one, both as regards strength and malleability. The fact that there was no sure way of telling whether bars were thoroughly annealed and yet not weakened by over anneal makes the physical results given a little uncertain as representing an iron corresponding to the analysis accompanying the results, and only by averages of many tests can the truth be known.

Mr. Sanford's paper is accompanied by a series of tables of tests and analyses, for which we refer to the original.

Pressure on Molds.

H. M. RAMP.

PART III.

The explanations as given in Part II., of Pressure on Molds, simply treats of methods to resist pressure on copes when used over pits, but make no provision for the trouble so often experienced from the pressure as shown in Tables No. 3 and 4, published in July issue of The Foundry. The writer has noticed upon several occasions where the floor was treacherous or sandy, and the castings made were deep and exerted great strain, that unreliable ground has often caused disaster. One incident especially comes to mind. A molder was making a pile-driver in the floor, about four feet deep which would weigh between forty and fifty hundred, and the pressure at bottom counting hight of cope amounted to fifteen pounds per square inch. The shop had been built in a place where the soil was of a quicksand nature, and the floor had been filled in about five feet. Upon pouring the casting it filled nicely to the top of the flask, when the bottom of the pit gave away, and the entire amount of iron disappeared through the quicksand, causing an eruption not unsimilar to a minature volcano. The result was not only the loss of time of molding, but the iron was never recovered.

This trouble could have been easily avoided if a very simple precaution had been taken, a cast iron plate laid in the botton of the pit or even a bottom board would have presented enough surface to the sand to easily resist the pressure. We often encounter the same trouble in pits made in filled ground, through pressure sideways, and where extreme depths are reached, even the natural ground will sometimes give. Some resort to the plan of walling up the pits with brick which makes a very nice job and is easily dug out, also retaining its shape or size of the same is often changed.

An example of the effects of extreme pressures was shown in a northern foundry recently. The firm had the contract to make a number of large cast iron pipe sixty inches in diameter and sixty inches long. They were molded in green sand in the floor and cast on end, and supposed to weigh 6,500 pounds. The first casting made was rammed up in a good solid pit and cast successfully, but upon examination it was found to weigh 9,000 pounds and proved to be three-quarters of an inch too thick at the bottom end. As before stated the pipe was made in green sand, inside and out, and was rammed up carefully, and as solid as the sand would stand, and showed conclusively that the surrounding floor on the outside and and the green sand core on the inside, were not capable of resisting the pressure which amounted to (in round numbers), on both surfaces, over eighty-five tons.

To make them in loam or dry sand would have been too expensive unless the contract had been taken by a shop thoroughly equipped for such work, so the following plan was resorted to, and proved wholly successful. Three large rings sixteen inches greater in diameter than the pipe, and twenty inches wide, were made from quarter-inch boiler iron and rammed up in the pit, forming the outside wall. This left eight inches of molding sand between pattern and wall of pit and constituted a support that

never gave in the least and proved it was the solid ground that gave under the pressure. For the inside core a number of cast iron rings 42 inches in diameter were cast, with a few wings on to hold the sand, and rammed up in the center, this prevented a strain on the inside and the weight came as desired.

This rigging brings to mind another incident witnessed a few years ago, of a casting made which contained a large green sand core 48 inches in diameter and the same hight. Upon pouring the casting the pressure was so great at the bottom it squeezed the core in at that point and forced it out at the top, shutting off the casting there which was only three-quarters of an inch thick. In fact the sand squeezed out before the mold was full, showing how incompetent it was to withstand the pressure. The rigging spoken of or even a couple of old flasks rammed up in the core would have prevented this disaster.

Many examples could be multiplied and different methods shown where pits could be made strong enough to resist any pressure exerted. Cast iron walls of almost any formation could be made and bolted together to answer this purpose, even two-inch plank could be used to board up the pit so it would stand almost any pressure, for it is not the entire surface that gives, but the weak spots or holes in the surrounding floor, the places where old pits have been and connect with the new, which have been filled after using but never rammed solid. The manner of proceeding is not so essential as a study of the pressure and principle involved, and some knowledge of the pit to be used.

Cores in molds are often their most important feature, yet still receive little attention except through carrying off the vent. The mode of anchoring is often accomplished in a very desultary manner, often cores ten, twelve and even sixteen inches in diameter and of varied length will be set in sand prints, and the cope prints having an actual bearing of from four to six inches be expected to hold the core down when the pressure comes. For example, assume that a twelve-inch core is six feet long and only has the sand prints to hold it down. The pressure existed is 216 pounds to the foot, or a total for the entire length of 1,296 pounds. Would it be safe to think we could place a core with that weight upon sand bearings at each end, and not expect the same to settle the sixteenth of an inch? Yet this is often the practice we meet with and the instant the core raises a thirty-second the iron forces out under it. Hence many of our run-outs.

It is not always possible to place anchors on top of cores in the castings, as in cylinders or anything that has to be bored out, or when they are very thin or expected to be steam or watertight, but there is always recourse to the plan of placing them over the cores in the prints, and such methods should always be used where there is the slightest doubt of the sand holding.

Another trouble often experienced is placing anchors over round cores or almost any kind, is, they sink into the core a little under pressure, causing a casting to be not uniform in thickness.The point where the anchor rests and especially in the case of round cores, is very small, often a square inch of area is expected to stand several thousand pounds pressure, with no bearing but the sand the core is made from.

The result is plain and the anchor sinks into it a sixteenth or more. Another thing that assists this condition is: After standing in the mold some time the core draws dampness and renders the outside soft and yielding. To prevent such trouble it is always the better plan to make cast iron plates from two to five inches square and half an inch thick and ram them up in the cores or bed them in, as necessity may demand, at the points on the surface where the anchors touch. They can be made almost any shape to suit the form of the core, and a heavy coat of blacking will always prevent the iron from melting them.

The size must be governed by the pressure that is light, two inches square will often hold, but as it increases the size of the plate must be increased to get more surface for resistance.

Ordinarily these plates will stand the pressure, but sometimes when extreme pressures are to be held and a series of cores placed upon each other, the following method is necessary. Assume a casting to be made five or six feet deep, with a series of cores from ten to twelve inches square in it, with partitions between them an inch and a half thick (this is a common casting used in bridge-building), and see what an

enormous pressure is exerted upon both top and bottom anchors on the top core. They carry the entire pressure from bottom up. In such a case the result would be to force the plates into the core, if simply bedded in the core sand. However, make plates for both top and bottom anchors, and in making the cores cut off pieces of gas-pipe of bar iron to fit loosely between the two plates and ram them up in the core., or even pieces of scrap iron built up while ramming will answer the purpose. This will give a bearing of iron to iron all the way through. One item in connection with this must be observed, if pipe or bar iron is used they must be cut about three-quarters or an inch short and the space filled with a block of hard wood, for when the casting shrinks on the core and diminishes the distance between the two plates, if no provision is made for the same the bars or blocks between the plates will either break the casting or wedge them in so tightly it will be impossible to remove them; while if the blocks are used of hard wood, when the core gets hot they will burn to charcoal and allow a space for shrinkage in the core. This plan renders it practically impossible for the plates to squeeze into the core, no matter what the pressure may be. It is often hard to tell the correct size anchors to use. An eight-inch column core with the metal one-half inch thick can be held with quarter-inch anchors, although it is not advisable to trust that size, while if the same were two inches thick it is very doubtful if one-half inch anchors would stand.

We have no guide as to the size of them to use by knowing the pressure exerted, for the body of iron around the anchors and their position relative to the gates are the factors that decide the size and weight. In a thin casting, as we all understand, the iron chills quickly and their crushing strength is but slightly impaired, but when the body of iron runs two or more inches thick, the anchors must be made five-eighths to three-fourths and upwards to resist the same strain a quarter-inch rod would in a light casting. Also, if the gates strike near or directly on the anchors, their size must be increased, for the flow of the iron heats them very rapidly. The supposition that because a core does not cut through to the cope, that it did not raise any is wrong. Many a casting contains cores that have only partially raised, and they are in such positions it was impossible to discover the defect.

The cause for this is: The anchors had been heated hot enough to squeeze out partially, but not enough to permit the core to cut through, and especially as the portion next to the core and mold quickly forms a hard or cooled spot that does not give so easy. Anchors an inch and a half square have been known to crush to half their size in castings two inches thick at a pressure not equal to one-tenth their crushing strain when cold. When they are placed in front of gates or when the iron flows in a continuous stream until the mold is filled, special attention must be given. The writer has been compelled to use cast anchors two and a half inches square in a casting that only weighed 3,000 pounds, because it came directly in front of the gate. These things, as before stated, require a careful consideration of the work at hand and the use of good judgment.

Another of our probable errors in this direction is the niggardly use of anchors. They will often be placed seven, eight and even ten feet apart on small columns or pipes, and the cores may be weak or unreliable. Of course the casting may not be lost or the defect observed, but the fact remains the same, that a casting without a uniform thickness does not make as strong a casting, even though it is accepted and used. Many crooked castings can be traced to this cause, also, for a pipe made with one inch thickness on one side and one-half inch on the other will surely be crooked unless provision is made for making it in that manner. These faults are all the outcome of ignorance or carelessness of the principle that rules and governs pressure.

How much could be written on this subject is hard to tell. How many disasters have we witnessed through such and similar causes. Look in the scrap-pile and see examples of neglected pressure, castings that run out at the bottom, bursted through bottom boards, raised copes or cores; glance in the chipping room and see the chippers endeavoring to cut some swelled or strained place off a casting to make it presentable and accpetable; visit the machine-shop and notice the trouble and time it takes the machinist to bore a hole where the core has partly raised or bent, or where the face of

casting has strained so as to necessitate extra labor, and you will not be surprised that it is proverbial that the machinists bless the molders. Take a stroll through the flask yard and use your powers of observation. Notice how this and that flask has been burnt out by run-outs, how this one gave in the corners and had to be repaired, and possibly a large cope will strike your gaze that has a couple of large timbers nailed across the center, a flask that was not strong enough and had no iron bars and the center gave or raised. Here and there flasks will be seen where the drags are long and have no support to hold them together in the middle, all being witnesses to mistaken ideas and judgment regarding pressure, things that are always found out afterwards, when the damage is done, and in many cases faults that could have been avoided. There are some things in connection with these tables and examples shown that may be questioned. First, some may say plates of the size given in the table have been made and held down with less weight than these given, and their statement may be true for three reasons. The cope on a mold always weighs something, and whatever that weight may be is just so much to help resist the pressure. Also, it is seldom in pouring a large plate or casting that the gates are brought up full, and every inch below the depth cuts off one-quarter pound per square inch of surface, so it can be easily seen why these things may appear in error at times. However, it is always necessary to figure the entire depth of cope, for a mistake in the man watching up, or some little trouble with the ladles, could easily fill the gates when not desired, and the weight of the cope should always be used as a safeguard over the actual weight required. This same is true in side pressure. Weak flasks often hold that which it seems incredible when table No. 3 is consulted, but here is also a reason. Often the cope and bottom board fits up close to the drag, and when clamped together hold it as in a vise, but this cannot be depended on. It is not a question of how can work be made in the most dangerous fashion and be good, but how can we remove all possible danger.

This question of pressure and their attendant fitness must and will receive greater attention in the future. There is a field for study that requires the use of brains and mathematics, and the writer would consider it a favor to hear from other men on the same subject.

James Chalmers.

The History of a Tramp Molder.

W. EDWARD.

CHAPTER XX.

It was after four o'clock that evening before we reached Memphis and we had to hustle to take in the shops before quitting time. The Millburn shop was nearest to the depot and we made first for that. The whole plant was inclosed with a high board fence, and signs were posted conspicuously at every door, "No admittance; apply at the office." On applying at the office we were told that they were in need of molders, and we were permitted to go into the shop to see "old man" Bellows' the foreman. He proved to be a peculiar sort of an old chap, rather cranky in his ways and crusty of speech. When we made known our errand he told us at once that he wanted men, not boys, although neither of us had much the appearance of a kid. It was useless to argue in a case of this kind, so we left the shop and took a car down to the city. It was nearly six when we struck the Chickasaw, the bottom was dropped and the men were washing up to go home. I asked the first man I saw to point out the foreman to me. He told me that the foreman was away on a vacation, and that "Andy" Bevan was acting in that capacity, at the same time pointing him out to me. I braced up to "Andy" and said, "There's two of us here looking for a ob; if you want us we'll come out in the morning." "All right," said "Andy," "I'm glad you came along, as I want a couple of men. You can come to work in the morning ing." As I turned away, after assuring him that we would be on deck, he called me back and said, "There's one thing I forgot to mention. Unless you have your cards with you it won't do you any good to come out, as this is a strict card shop." I showed him my card and assured him that my partner, who had remained at the door and allowed me to do all of the talking, was similarly fixed.

We found a boarding house handy to the

shop, to which we carried our "grips" and were ready for work the next day. In Memphis, as in most of the other Southern cities, the rush of work is in the summer, when all of the available men are hired and the work hustled out, then the new comers are laid off, and along about the first of November the shop goes on nine hours and three to five days a week for the winter.

There was plenty of work on hand when we struck the town, and the prospects were that the rush would continue until late in the season, but about the first of September a yellow fever scare struck the city and everything fell flat. Only nine years before Memphis had been almost depopulated by the yellow fever epidemic of 1879, and possibly those who had gone through the former siege had good reasons to feel uneasy. At any rate, as soon as the fact became known that there was yellow fever at Jackson, Miss., and at New Decatur, Ala., the city was ordered under quarantine and the local militia encircled the city and allowed no one to enter, not even farmers from the surrounding country coming into the city with produce. The railroads running north did a rushing business for a few days, during the height of the panic, carrying the fever-scared people away from the city; in one day eleven thousand people left by rail, besides those who went by boat and those who crossed the river into Arkansas, to camp in the woods until the scare was over. As for myself, I felt no uneasiness on the score of the fever, the only thing that bothered me was, that unless the scare let up pretty soon I would be out of a job, as there was no new work coming in and two or three of the men were on stock work. Highams, the foreman, didn't care to let us go, in the hopes that the scare would soon be over and things would brighten up again, and as we two were the only strangers in the shop he kept us on as long as he could.

Toward the last of September the scare still continued and business grew worse every day, so he was compelled finally to lay us off. For the first time since I had been on the road I put some money in the bank and I had a nice little stake to travel on. When Ed and I struck the town we had about $25 apiece. As soon as we got to work I proposed that we put $20 in the bank and add to this each week all we could spare. Ed wouldn't accede to this, but I deposited my $20 and every Saturday at noon I made a point to rush up to the bank and deposit $10 of my week's wages. We worked just seven weeks and when we were laid off I had the satisfaction of having $90 to my credit in the bank. while Ed didn't have a dollar except the week's wages coming to him.

A few days after we had been laid off I heard that there was a job at Livermore's, but as I had money enough to keep me for a while and had concluded to go North, I gave Ed the show. He got the job all right, but he only lasted one day, claiming that Sam Howles, the foreman, yelled too loud to suit him. Sam had a voice like a fog horn and he was fond of exercising it. If he discovered a bad casting in the chipping room he would come to the foundry door and yell for the man that made it to come and look at his work. It seems that Ed had lost a small piece the first day and when it was discovered the next morning Sam informed him, loud enough for every man in the shop to hear, that if he couldn't do any better than that he would "fire" him. Ed walked back to his floor, put on his coat and demanded his time, when Sam tried to persuade him to go on with his work, as he was only joking.

I lay around for a week to see if things would change for the better, but as the quarantine was still in force and there was not much prospect of business reviving before spring I took a boat for Cincinnati.

About twenty miles up the river the captain attempted to make a landing, when he was hailed from the shore and advised to keep in the middle of the stream or suffer the consequences. It was quite dark by this time and the search light was thrown on the bank to see who had hailed the boat. On a high bluff above the landing a dozen men, each armed with Winchesters, ready to defend their homes at any cost from contagion of the dread scourge, were drawn up in line. The captain concluded that, under the circumstances, it would not be healthy to make a landing at that particular point, and after an exchange of some strong language, in which the captain declared that there wasn't a case of yellow fever within a thousand miles, the boat backed out into the channel and puffed on up stream. We met with no

further incident and reached Cincinnati on the fifth day after leaving Memphis. While the boat was making its way through the canal at Louisville, I got off and took in all the shops in search of work. I struck a job in one of the small shops, but the best wages they would pay was $2.00 a day, and I concluded to go on to Cincinnati.

The first shop I struck in Cincinnati was Hoefinghoff & Laue's, and I asked one of the men to point out the foreman. He looked around the shop for a minute and said he supposed Girth was out "chasing" a drink, and advised me to brace the first big man I saw wearing a dirty white shirt. I stood around the shop for a few minutes until I saw a man come in who answered to the description given. I walked over to where he stood and asked if he was the foreman. Without turning his head or replying to my question he asked what I wanted. I repeated my question, and he asked again, without turning his head, "What do you want?" For the third time I asked the question, and turning sharply on me he said, "Yes, I'm the foreman; what in —— do you want?" "Excuse me," said I, "I just wanted to know whether you were the foreman or the owner of the shop." Joe knew I was making game of him, but he didn't say anything, and I turned and walked out of the shop. While I stood there waiting for him to come into the shop and saw the way every man was "rooting" I concluded that I was not hard enough up to want a job there, and this conviction was strengthened when I saw the foreman. I worked for Joe a couple of years after that, however, but I was pretty hard up, and I only took the job to raise a stake. It was early in the spring and work was scarce everywhere. I had been in every shop in Cincinnati without getting a show for a job, and as a last resort I thought I would strike Joe Girth. I had sized him up pretty well the first time I saw him and felt pretty sure that if I showed the white feather I would get no show with him. I was pretty close run and had only fifteen or twenty cents in my pocket, but before tackling him I bought a good cigar and sauntered into the shop as if I had lots of money and time enough to spend it. Joe saw me as soon as I got inside the shop, but I was in no hurry to tackle him, hoping to give him the impression that I was independent and didn't care a cuss whether I got a job or not. As soon as I got a good opportunity I asked him whether they were busy and what show there was for a job. He asked where I came from and whether I had ever worked in the city. I said I had just come from the East and had never worked in Cincinnati. This seemed to please him and he said that he could put me to work if he could find a floor for me, and told me to come around the next afternoon. The following afternoon I went around again and as soon as he saw me he said, "By ——, young fellow, I forgot all about you, but come out tomorrow anyway." I didn't know whether he meant for me to show up for work in the morning or to go around to see if he had found a floor for me. But I concluded that I would adopt the latter course, so I did not go around until after noon. As soon as Joe spied me he said, "Say, young fellow, do you want work?" "Certainly I want work," said I, "what do you suppose I am hanging around here for if I didn't want work?" "Well, why didn't you come out here this morning? I stayed here last night until after seven o'clock cleaning up a floor for you." I reminded him that he had forgetten all about me the day before and I didn't know whether he would remember to fix a floor for me that afternoon. He looked at me pretty hard for a minute and then told me to go and see if the floor suited me and if it did to come out the next morning. I worked there for two months and found that it was not such a bad place to work, if a man had independence enough to hold his own with Joe and not get scared every time he yelled. I have often thought, though, that Joe Girth missed his calling when he entered a foundry. As a mate on a Mississippi steamboat he would have been a success.

I spent three days in Cincinnati looking around the shops, and while there I thought I would visit the headquarters of the Union, thinking they might give me some pointers about where to look for work. I went into the office and asked for Mr. Fitzpatrick. The clerk went into an inner room and in a few minutes "Fitz" came out with a dime in his hand, supposing, of course, as I was a molder, that I was in need of financial assistance. He seemed quite surprised when I refused the proffered dime and asked him if he could tell me where there was any

show for work. He returned a negative answer to my question and I left the office no wiser than I entered.

Finding nothing to do in Cincinnati I went up to Hamilton, where I missed a job by about ten minutes at the Niles Tool works. Then I went to Dayton the same afternoon. A molder whom I met in one of the shops put me "next" a job which he had heard of and I went to see about it the next morning. I started to go into the shop, but the superintendent stopped me and said he would send the foreman out to the office to see me. When he came out I asked if there was any show for a job, and he told me that he could give me a job at which I could make $7.50 a day and not work very hard, but I would have to pay two helpers out of that. I asked what kind of a job it was, and he explained that it was a cable yoke and I would be expected to turn out 15 a day. "But one of the helpers will have to ram," said I. "Yes, of course," said the foreman, "all you have to do is to ram the cope and finish, while one of the helpers rams the drag and rolls over." "Well, excuse me," I said, "my business is to make molds and not molders," and I walked out of the shop and took the train for Springfield.

(To be continued.)

Books, Exchanges and Catalogues

The subject of mechanical draft is one that of late years has been given much attention among engineers. It is said that three-fourths of the vessels in the United States Navy are supplied with the Sturtevant apparatus for this purpose, and judging from a recent pamphlet on this subject, published for free distribution by the Sturtevant Co., it is fast becoming popular for stationary boilers as well.

Anyone thinking that all the stoves and ranges in the country are made in the northern states would discover their mistake were they to see the handsome catalogue just sent us by the Georgia Stove Works, Atlanta, Ga. They appear to manufacture an extensive line, especially in cooking stoves, and being near the base of supplies, ought to be able to gather in much of the rapidly growing southern trade.

A few days ago the express company delivered at this office a portentious looking package that, upon opening, disclosed a box that looked as if it might contain a photograph album, dictionary, encyclopedia or something on that order.

It proved, however, to be the latest catalogue of the Michigan Stove Company, its size being only one of its many original features.

It is divided into several sections, devoted to the various lines made by them, such as steel ranges, Garland and Michigan cooking stoves of all sizes, Garland and Art Garland heaters, Oaks, etc., and each section filled with half-tone reproductions from photographs of every stove made of each line.

These sheets are loose and of heavy calendered paper and by inserting new sheets as fast as they are sent out the catalogue is kept up to date.

Taken altogether, it is probably the most elaborate thing of the sort we have ever seen and is certain to attract much attention.

A Lucky Accident.

Why a "Jackstone" Maker Turned Attention to Puzzles.

As an example of how a remunerative specialty in hardware forced itself on a receptive and appreciative Yankee, the following incident will be of interest:

Among manufacturers small castings are often put in revolving cylinders with pickers or stars made of cast iron, having usually six points, the extremes of which are about an inch apart.

They are also familiar to toy dealers, who sell them to children as "jackstones." The pickers, together with small castings, are put into the tumbling barrels, so that any particles of sand adhering may be removed and a better finish given the castings.

A large and well-known New England concern, which, in addition to the other lines, manufactures screw wrenches largely, formerly used a peculiarly shaped malleable iron ferrule, with irregular openings at the four sides and circular openings at the two ends, weighing an ounce.

Some of the ferrules chanced to be a part of the contents in one of the tumbling barrels.

When the barrel was opened the attendant noticed, what to him seemed almost increbible, that the picker with oll its prongs was inside the ferrule, the openings of which were comparatively small. The observant mechanic logically concluded that as it had got in it could be got out again.

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UNEQUALLED
EFFICIENCY, DURABILITY,
MINIMUM POWER.
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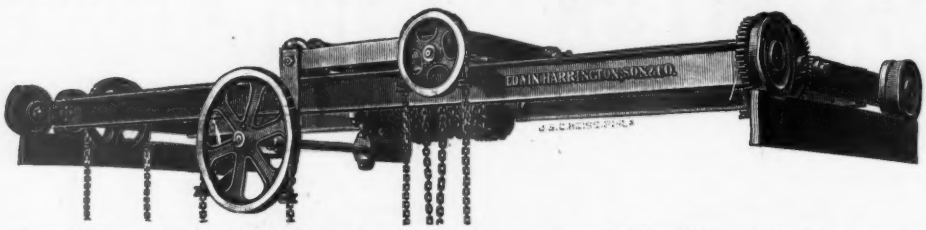

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The chains wind on a drum, having right and left spiral threads. The hand chain wheel is removed from the line of the load by means of extended shaft, a fact which is of great advantage to the operator. The crane is supplied with roller bearings and travels with an easy steady movement. It is equally well adapted for heavy or light loads.

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THE ART OF MOLDING

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CORE-MAKING, LOAM, DRY-SAND, AND GREEN-SAND MOLDING, ALSO CRYSTALLIZATION, SHRINKAGE, AND CONTRACTION OF CAST-IRON, AND A FULL EXPLANATION OF THE SCIENCE OF PRESSURES IN MOLDS; ADDED TO WHICH ARE FORMULAS FOR MIXTURES OF IRON, TABLES, RULES, AND MISCELLANEOUS INFORMATION.

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The Best Material Only. Complete Analysis and Careful Testing . . .

In the Largest Chemical and Physical Laboratory devoted to Foundry Iron in the United . . States is what makes . .

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THE IRON IT IS

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Made throughout of the best quality of high grade steel. Tray stamped without joint, seam or rivet, with edge bound over steel rod. Handles, Legs and Wheels the strongest put upon Tubular Barrows.

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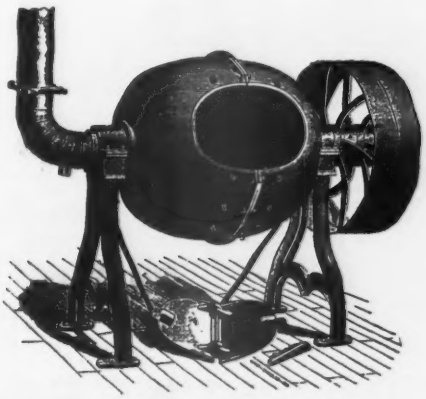

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Hand-Made Pig Iron Barrow

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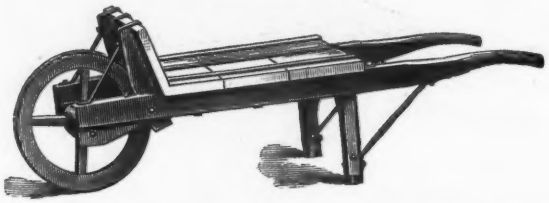

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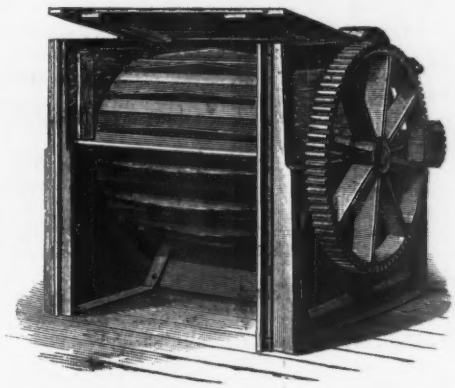

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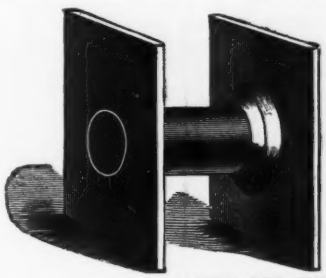

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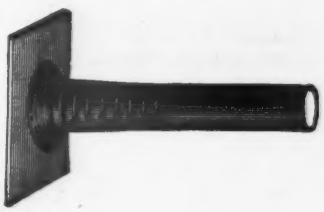

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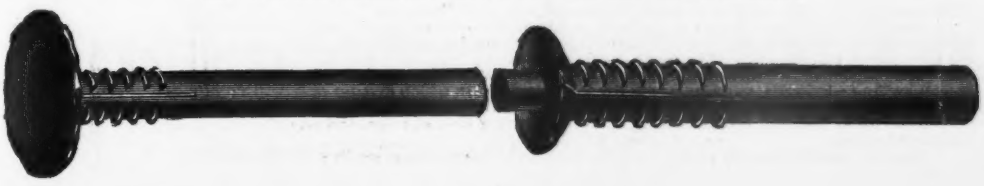

Alphabetical Index to Advertisers

	PAGE
Albany Facing Mill Co., The	39
Adjustable Snap Flask Co.	36
Ayers, E. M.	8
Berlin Iron Bridge Co.	14
Brown & Sharpe Mfg. Co	31
Brooklyn Fire Brick Works	29
Buffalo Forge Co.	25
Chicago Photo Eng. Co.	36
Canton Fillet Co.	32
Cleveland Chaplet Mfg. Co	31
Cleveland Facing Mills Co	2
Clinton Iron & Steel Co.	26
Connersville Blower Co.	Back Cover
Cowles Electric Smelting and Aluminum Co.	Inside Cover
Craig Ridgway & Sons	19
Devlin, Thos. & Co.	38
Dixon Crucible Co., Jos	39
Eastman Kodak Co	34
Foundry Outfitting Co.	21
Fox Machine Co	35
Garden City Fan Co.	37
Garden City Sand Co.	40
Gobeille Pattern Co., The	36
Gould & Eberhardt	35
Halpin, Wm.	19
Hussman Crucible Co.	37
Harrington E., Sons & Co.	26
Kilbourne & Jacobs Mfg. Co.	27
Keep, W. J.	28
Lansing Wheelbarrow Co	28
Millett Core Oven Co.	12
Milwaukee Foundry Supply Co.	36
McCullough, Dalzell & Co.	6
Obermayer Co., The S.	1
Paxson & Co., J. W.	4
Phœnix Iron Works Co	18
Rochester Optical Co.	29
Roots Company, P. H. & F. M.	Colored Insert
Smith Foundry Supply Co., The J. D.	Cover
Stebbins Mfg. Co.	33
Stewart, W. H.	39
Stow Flexible Shaft Co	5
Stover Mfg. Co.	27
Sturtevant & Co. B. F.	10
Tabor Mfg. Co.	22
Taylor, Robt. J.	5
Timmis & Clissold	38
Tompkins Vreeland	37
Washington Coal and Coke Co	13
Whitehead Brothers Co.	3
Whiting Foundry Equipment Co.	22
Wrought Iron Bridge Co.	13
Wilbraham Baker Blower Co.	11

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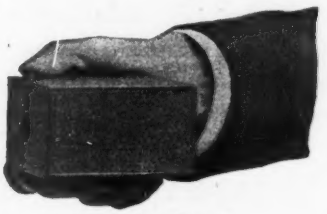

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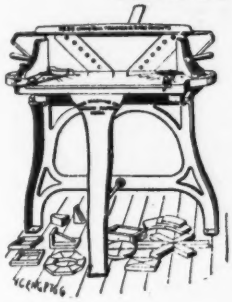

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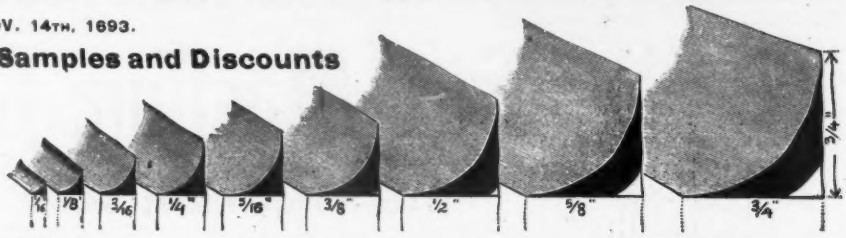

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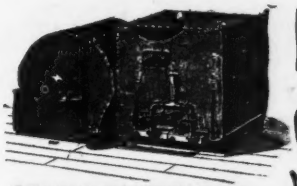

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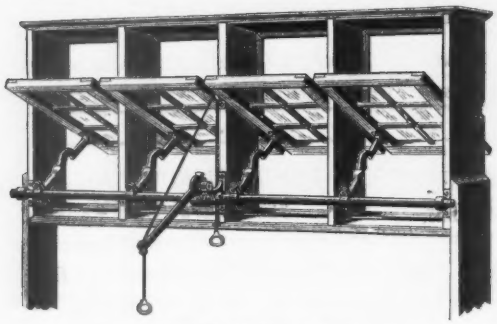

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